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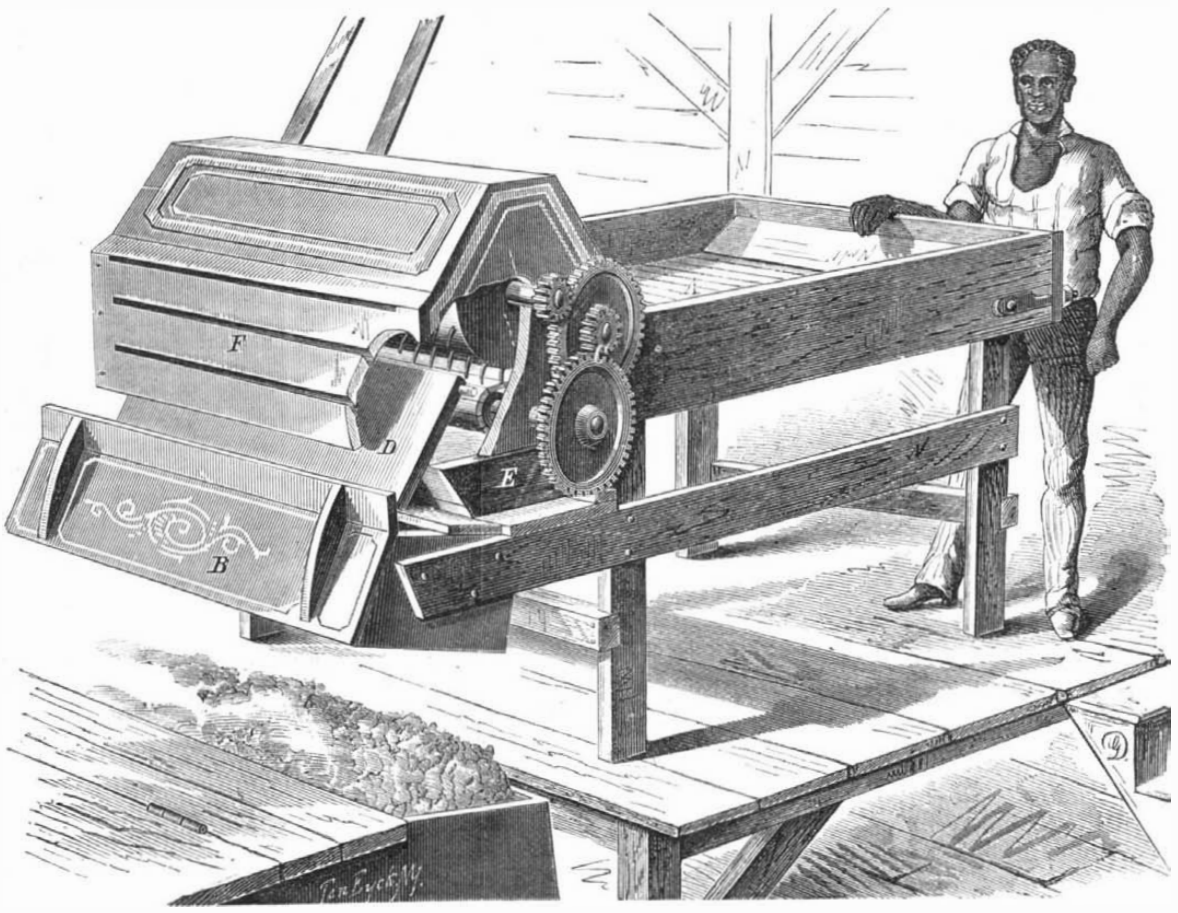
IMPROVED COTTON GIN FEEDER.

The principal difficulty found to exist in inventions of the class to which that illustrated herewith belongs is that, as a rule, they are too complicated for ordinary laborers to understand their workings, while, in addition to this, in many cases the mechanism is troublesome to repair. The cotton gin feeder shown in the engraving, it is claimed, possesses the advantages of simplicity, durability, and adaptability to the labor common to the cotton plantations of the South.

A is an endless belt which conveys the cotton to the toothed drum which, in turn, feeds the material to the breast, B, of the gin. The shafts of the drum and of the roller over which the belt, A, passes, are geared together by the train of wheels and pinions, C, in order to cause them to turn relatively to each other at the proper rate. On the opposite side of the apparatus the drum shaft, by suitable mechanism, is geared to a band wheel, so that the feeder may be driven by a belt from the gin. These gears are so contrived that they may be readily interchanged, so that the driving gear may be placed on either side, as may be required by the gin, which cannot always be arranged in the same relation to the feeder. This adapts the machine for application to any gin.

The driving pulley shaft is arranged on a slide, not shown, which is shifted by a lever for throwing the feeder in and out of gear. D is the apron which delivers the cotton to the gin breast. This is arranged a little in advance of the bed on a pivot, so as to turn freely to accommodate itself to the position of the breast, which has to be raised and lowered at times; also to make a space through which the trash may fall, and sand and dust may be blown by the drum into the trough, E, below. At F are the ventilating slots in the hood for the escape of the light dust caused by the blast of the drum.



FLYNN'S IMPROVED COTTON GIN FEEDER.

Patented through the Scientific American Patent Agency, April 20, 1875, by Mr. F. W. Flynn. For further information address Messrs. W. H. Lockwood & Co., 130 Poplar street, Memphis, Tenn.

Straightening a Tall Chimney.

A high factory chimney in Havre, which during the process of building had, owing to the sinking of one side of its foundation, been thrown out of perpendicular, was recently straightened in the following manner: The earth on the side opposite to that toward which the chimney inclined was dug away to the foundation bed, and for a width of six feet. On the wide lower course, pillars of masonry were erected, which supported a heavy staging, on which some 30,000 paving stones were piled. The effect of this immense load was to cause a sinking of the structure beneath, which, in six weeks, resulted in the straightening of the chimney the, top having passed through an arc of 31 inches.

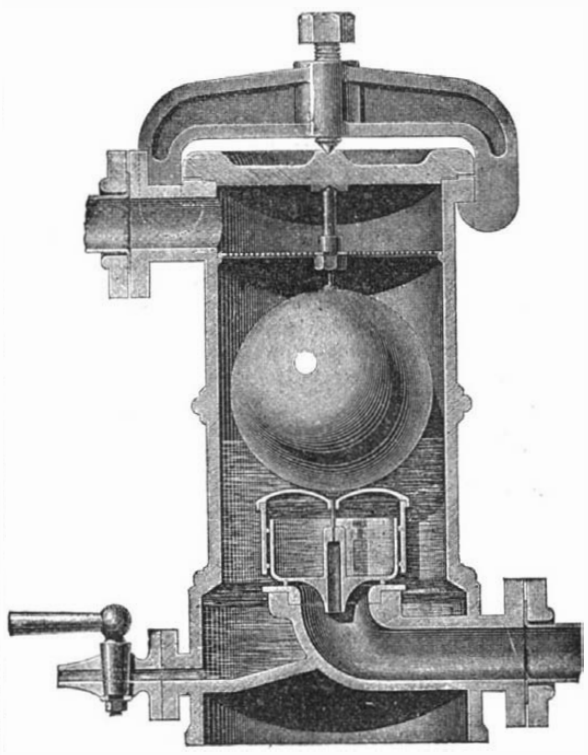
Figures Printed by Lightning.

Persons who are killed by lightning stroke are frequently found marked about the body in a peculiar manner, the lines being grouped into semblance of the trunk and branches of a tree. In case the casualty actually happens anywhere in the vicinity of a tree, the ramifications are attributed to some mysterious property of the lightning, which reproduces on the body (as was stated in a published instance) "the fibers, leaves, and branches with photographic accuracy."

Mr. C. Tomlinson, in a communication to *Nature*, states that the trees have nothing to do with the figures, which are produced directly by the lightning. The same markings may be found in sheets of crown glass by passing over them the contents of a Leyden jar. The writer, however, mentions a variety of curious phenomena in which horseshoes, metallic numbers, etc., have been found reproduced on the persons of people struck in their neighborhood. Mr. C. F. Varley throws light on these last mentioned cases in giving the record of an accidental observation made during the working of a Holtz electrical machine, the poles of which were furnished with brass balls about an inch in diameter. Noticing some specks on the ball of the positive pole, Mr. Varley tried to wipe them off with a silk handkerchief, but in vain. He then examined the negative pole, and discovered a minute speck corresponding to the spots on the positive pole. This pole sometimes exhibits a glow; and if in this state three or four bits of wax, or even a drop or two of water, be placed on the negative pole, corresponding non-luminous spots appear on the positive pole. Hence it is evident that lines of force exist between the two poles, by means of which we may telegraph through the air from the negative to the positive pole. And in explanation of the above cases, in which the lightning burn on the skin is of the same shape as the object from which the charge proceeded, all that is necessary is that the object be + to the horse shoe, brass number, etc., the discharge being a negative one.

CONDENSED WATER TRAP.

Mr. A. L. G. Dehne, of Halle, Germany, has patented a very simple trap for removing automatically the water of



condensation from steam heating and other pipes, which will be understood at a glance on our engraving. When the water has accumulated sufficiently to raise the globular float, the pin attached to the float is lifted from the valve, which is formed of two cup-shaped vessels (one in the other, as shown) kept normally in equilibrium by the steam pressure; but the raising of the pin releases the pressure on the interior cup, and allows the water to flow off till the balance of the valve is restored. The action appears to be very easy; and the valve will, no doubt, work continuously so long as condensation takes place.

The Mechanical Force of Light.

It may not be altogether premature to take a survey of the possible applications of the new power which Mr. William Crookes has shown to be derivable from light. Seeing that, by means of the sun's direct rays, he has been able to cause the vanes of his small radiometer to revolve four times in a second, it becomes evident that, with larger and improved appliances, we may hope to obtain motive power cheaply from a practically inexhaustible source, namely, the sun itself. The fact that luminous undulations are capable of exerting a motive force, of a nature so gross as that required to turn the vanes of a poised cross, will also render the comprehension of the chemical disturbances which are often effected by light, and which are exemplified in the union of chlorine with hydrogen when exposed to sunlight, in the production of the photographic image, etc., a matter of much less difficulty than it was heretofore.

The discoverer of these extraordinary phenomena confesses that he himself is unable to account for them by any satisfactory theory, and wishes to avoid proposing any until a sufficient number of facts have been accumulated. The facts will then tell their own tale.—*English Mechanic.*

Importance of Crocodile Study.

Professor Huxley has undertaken the duties of the chair of Natural History in the University of Edinburgh for the present summer session, and lately gave his introductory lecture to a large audience. He expressed at the outset a hope that at this time next year Professor Thomson would be among them again, full of health and vigor, laden with the spoils of many climes through which he had traveled, and a sort of zoölogical Ulysses, full of wisdom for their benefit. He then took a general view of his subject, and put before the class the considerations which resulted from the careful study of a single animal, the crocodile; an animal which was worthy of attentive study, as it might be said that a knowledge of its organization was the key to the understanding of a vast number of extinct reptiles, and the key to the organization of birds; while it helped them to connect the higher with the lower forms of vertebrate life, upon the globe. There might be asked respecting this animal, as respecting every other living thing—first, what was its structure? second, what did it do? third, where was it found? and fourth, in virtue of what chain of causation had this thing come into being?—this last having only been recently recognized as one of those questions which might legitimately be put. He then proceeded to describe the organization of the crocodile—its morphology, physiology, and distribution; and remarked that there were few animals about the palæontological history of which they knew so much, as they could carry back its history through the tertiary and secondary epochs. The answer to the last question constituted ætiology, or the science of the causes of the phenomena of morphology, physiology, and distribution. Here, as in all cases where they had to deal with causation, they left the region of objective fact and entered that of speculation. With their present imperfect knowledge, the only safe thing they could do in attempting to form even a conception of the cause of this extraordinary complex phenomenon was what a wise historian would do—stick by archæological facts. He pointed out that palæontological facts showed that there has been a succession of forms of that animal to the present day, the oldest being something like the lizard.—*Nature.*

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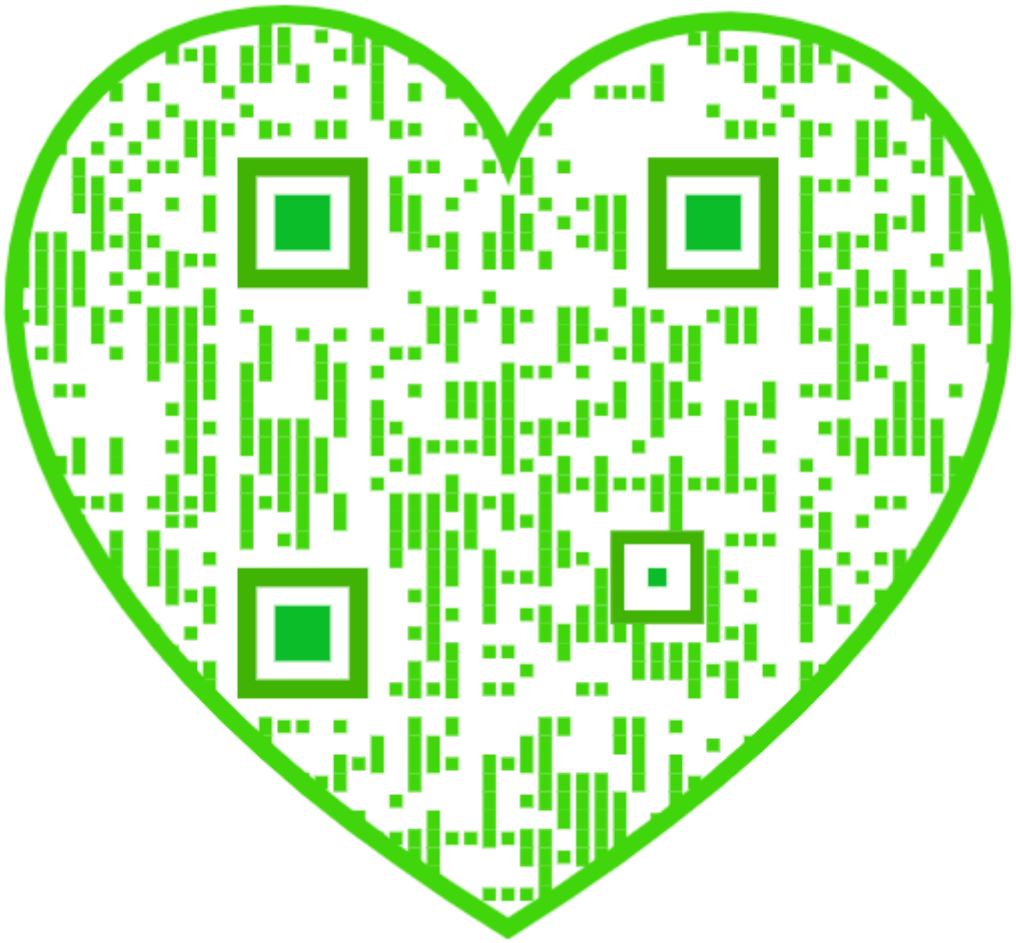

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PATENT POLITICS IN OHIO.

At the recent State Convention of the Republican party in Ohio, for the nomination of State officers, the following resolution was unanimously adopted as the policy of the party

"SIXTH.—*We demand such a revision of the patent laws as will relieve industry from the oppression of monopolies.*" By the acceptance of this resolution, all the candidates, on the Republican ticket in Ohio, now stand publicly pledged to use their best endeavors to deprive the citizens of that State, and other States, of their existing rights to obtain patents. This may be a good way to gather votes, but to us it looks like egregious folly.

If there is any one law that gives more satisfaction than another, to working men, mechanics, inventors, and the public in general, it is the patent law, which secures to the humblest individual limited rights and property in new thoughts or inventions; and the attempt of these politicians, to legislate these rights away, will, we are confident, be scornfully rebuked by the masses of the people.

The existing patent laws of the United States secure to every man, woman, or child, who makes a new and useful invention, the exclusive monopoly thereof for the period of seventeen years; after which the invention becomes public property, and all persons may freely enjoy its use.

Under the stimulus of these beneficent laws, hundreds of new arts and occupations are yearly added to the national industries, contributing marvelously to the development and prosperity of the country. The great State of Ohio has long been prominent for the number and usefulness of the new inventions made by her citizens; while her remarkable growth in population, manufactures, and wealth is very largely due to the encouragement she has always given to the extension of patent monopolies within her borders. Many of her towns and cities are largely dependent upon, and in some cases have been nearly built up by, patent industries.

Indeed, it is questionable whether Ohio could to-day harvest her crops or carry on ordinary industrial operations if her citizens did not make use of hundreds of these monopolies which her astute Republican politicians now join in denouncing as disastrous to industry. We think they must know better. But if they are in earnest, if they really believe that industry is oppressed by patents, we advise them to commence at home and clear them out of their State.

Let them begin, for example, at Springfield, Ohio, a thriving town brim-full of patent monopolies. Let them take, first, the Champion Harvester concern, where they turn out reapers and mowers at the rate of one complete machine every four minutes. The great West is supplied with these splendid machines, they have a world-wide reputation, the farmers think they cannot get along without them; while hundreds of families at Springfield live in comfort by industriously engaging in their manufacture; and the founder of the concern, once a poor, struggling, inventive mechanic, after years of exertion, has made himself comfortable, if not rich, by his monopoly. But this sort of thing, say the politicians, is oppressive, and ought no longer to be tolerated To be sure, the patent will expire before long, by its own limitations; but if we are to believe the politicians, it ought to be broken up forthwith, and the industries of Springfield and other Ohio towns should in future be strictly guarded, by legal enactment, against the introduction of any more of such prosperity breeding, but oppressive, industrial patent monopolies.

CIVILIZATION BY UPHEAVAL.

The observations of Professor Marsh touching the cranial capacity of extinct animals show that the tertiary period of geology was peculiarly a period of brain development. What the determining condition of this remarkable increase of brain bulk and capacity for intelligence may have been, it is impossible to say; all we know is the fact that, at the time when, as the evolutionists hold, man was developing from the higher primates through the acquisition of some twenty or more cubic inches of brain, the entire animal world was favored by a similar though less remarkable increase of brain bulk and brain power. If there was a transition at that time from the animal to the human by natural evolution, the change was not, as has been asserted, anything radically unlike the changes exhibited by the lower orders of life.

But it is not our purpose to discuss the problem of man's origin as man. Sometime during the tertiary period he appeared; and we propose simply to consider how the low type of humanity which prevailed at first may have been developed, by means of climatic changes, into the higher type with which human tradition begins.

It is admitted by all schools of ethnologists that man must have appeared in a warm climate; on a tropical island, say men like Wallace and Darwin, for there only would his naked skin be no disadvantage, there his physical weakness would not be overtaxed before he could devise means of defense, and there food would be abundant and unfailing. In no instance, to our knowledge, however, has any attempt been made to show how the inhabitants of such an island could be started on the road to civilization, and compelled to keep it.

The inhabitants of tropical islands do not improve of their own accord. The conditions of life under such circumstances are unchanging, and therefore progressive variation is uncalled for, if not impossible. There must be a steady change of environment, and change of a nature to compel increasing forethought and industry, to insure progression toward a higher order of life: a change which could have occurred to the primitive race of man only through a gradual refrigeration of the climate.

Take an island, for example, like Borneo. Its inhabitants are unchanging. Life is easy, food abundant, and all incentives to exertion absent. Peopled by a low race of savages and stationary as to climate, the history of one day would be the history of a thousand years. But suppose the climate to become cooler at the rate of one degree a century, as by the slow approach of a glacial period. From generation to generation the change would be imperceptible; yet in fifty centuries the tropical island would become an Iceland. Its fauna and flora would be entirely changed, and man would of necessity change with them. Clothing and shelter would gradually be called for. The spontaneous products of the soil would become less abundant, and less uniformly distributed throughout the seasons. Cultivation and care would become more and more requisite to secure sufficient food. From generation to generation the race would be compelled to study thrift, to protect their animal and vegetable possessions to aid them in the struggle for existence; and thus by slow gradation they would creep upward to a higher life.

A similar effect would be produced by a gradual geographical elevation; and it is a suggestive fact that the great centers of original civilization are regions of recent upheaval: the more recent the upheaval, the more advanced the human type. The youngest highlands of the world are the highest, those of the Andes and the Himalayas; on the one American civilization reached its earliest and highest development; on the other the white race originated. To the highlands of Thibet—the "roof of the world," as the natives call it—the traditions of all the great civilizations of Europe, Asia, and Africa point as the birthplace of the human race. Here the earliest white civilization had its origin. There were made the astronomical observations on which even the earliest science of the Egyptians was based: the most ancient records in the valley of the Nile figuring the heavens, not as they are seen in Africa, but as seen in Bactria, many degrees further north.

The geology of Upper India records a history such as we have imagined necessary for the development of a civilization. At a late period, geologically speaking, the entire region now occupied by the Himalaya mountains—and the Thibetan plateau so far as explored—was under the sea. At the time when the earliest traces of man begin to appear, it was a country of sub-tropical plains and fresh water seas. The recent river and pond shells of the Thibetan plateau are the direct descendants of warm water species, whose remains lie in the deeper strata, an evidence that the vast upheaval of the region was a gradual, not a sudden, change.

From this region, now barely capable of sustaining a sparse population, came the conquering herds which, at the dawn of history, overran the plains of Europe and Asia. In this region arose the race whose development is recorded in the Vedic hymns and the religious books of subsequent ages, and whose early traditions come down from the time of the gigantic turtles whose remains are buried in the deposits of those ancient fresh water seas.

It is altogether improbable that the earliest civilization was developed by an immigrant race after the country had reached its present altitude. Men do not leave fertile lowlands for sterile mountain regions except under compulsion, and they are not likely to improve by the change. Besides, the region is now too high to sustain, much less to breed, an energetic race, such as the men of Upper India must have been when they set out to subdue the world: and by their own account, they were driven from their native home by cold—the inevitable result of excessive upheaval.

Another proof that the country was at a lower level than it is now, when it served as the great hive of the white race, is found in the fact that high altitudes are as incompatible with a vigorous development of man as they are with the agricultural requisites for the sustenance of a dense population. Within moderate limits, uplands are conducive to health and vigor; but above four or five thousand feet, the rarefied atmosphere is incapable of sustaining man at his best. This is specially noticeable in all Alpine regions and on high table lands like those of Mexico. To a still greater degree is it seen on the Peruvian plateau, where the Spaniards found a highly civilized but degenerate race. At a period geologically recent, that whole region lay at a lower level. At first the slow upheaval must have pushed forward, in a continuous line, the social and intellectual development of the people. It made them, in a double sense, a rising race. Ultimately, however, the limit was overpassed: the environment became repressive, not helpful; the people lost vigor and were no longer able to push on their civilization. Later they became unable even to maintain it, and for some time previous to the arrival of the Spaniards they had been losing ground.

PROGRESS OF THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN.

By a recent act of the legislature of the State of New York, this great bridge property, which was commenced as a private enterprise, has become a public work, and the money to complete it is to be supplied from the treasuries of the two cities. The early finishing of the structure is therefore assured, and the work is now progressing with all possible rapidity. The last stone of the Brooklyn pier or tower was laid a few days ago—the last that can be placed until the cables are stretched. The tower now stands 271½ feet high from the tide level. In the tower as it stands, there are about thirty-five thousand cubic yards of stone, weighing about seventy thousand tons. The "saddles"—the things upon which the cables are to rest—will be put in place in a few days, and then work will cease for the present on the Brooklyn tower. It is expected that the New York tower will be finished before the end of the present season. It is over 200 feet high. The engineers also hope to finish the Brooklyn anchorage this season, and it is thought that before next fall the cables will be stretched across the river.

This bridge will have a greater span than any work of the kind now existing. The distance between the river piers is 1,600 feet. The total length of the bridge will be about one mile. The width of the roadway will be 85 feet, which is a little more than our famous thoroughfare of Broadway.

It is believed that one of the immediate results of the bridge will be to turn the current of increasing population to Brooklyn, and ultimately cause the annexation of that city to New York, in which case the latter will take rank in population next to London.

REFINEMENTS IN MODERN ASTRONOMICAL OBSERVATIONS.

The tools used by the modern astronomer are clocks to measure time, graduated circles to measure degrees and their subdivisions, telescopes to magnify distant objects, photographic apparatus to make permanent records of ephemeral phenomena, photometers to measure the comparative intensity of light, polariscopes to reveal the nature of certain luminous rays, and spectroscopes to reveal the chemical composition of the heavenly bodies.

The invention of the clock is of great antiquity; but it is to the wants of modern astronomy and other sciences to which it is applied (navigation, for instance) that the perfection with which they are now made is due. So with the graduated circles, which are applied to quadrants, sextants, octants, and astrolabes.

The telescope, invented by Janssen in Holland, about 1609, was successively improved by Galileo, Herschel, Dollond, Fraunhofer, and others, while lately Lord Rosse and our own Alvan Clark have surpassed all former efforts. But who can say what improvements the future has in store for the telescope, especially as liberal monetary compensation has become a stimulus to the ablest opticians, and the making of million dollar instruments has been discussed?

Photography is now largely used in astronomy, and the work done by it during the recent transit of Venus, in different parts of the earth, has enriched astronomical science with records of the highest value and permanency. One amateur astronomer, Mr. Rutherford of New York city, has for several years past applied this science to making records of the position of the stars, so as ultimately to obtain knowledge of their distances from us, and their motions in space; and in connection with this branch of the subject, he has invented instruments of measurement, to be applied to the photographic impressions, which have already given results superior in precision to the measurement by direct observation of the stars represented.

Photometric observations on heavenly bodies, comparin their relative luminosity and determining changes in thei

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nature or distance, have been brought to a high degree of perfection, especially by Zöllner, who used for this purpose the following apparatus: The polariscope, an ingenious tool invented by Malus in France in 1808, is based on certain peculiar properties of reflected light, by which it may be ascertained what light or portions of light belong to a luminous body itself, and which are borrowed from other sources; while it also shows the direction whence the borrowed light arrived before it was reflected by the body under investigation. Zöllner applied to this instrument several ingenious devices, making it the most perfect measurer of the intensity of light, and has thus founded a new branch of astronomical research, called astro-photometry.

The spectroscope, based on a discovery made in 1790 by Fraunhofer, and in 1840 by John W. Draper of New York city, is the invention of Bunsen in Germany, and, next to the telescope, is the greatest gift astronomy has ever received. By means of this instrument, Secchi, in Rome, has so successfully investigated the light of the stars that he has classified them by their temperatures, which may be distinguished by the number of dark lines or bands in their spectra; the hottest stars show the least number, the next class (to which our sun belongs) showing a greater number, and the third class having so many dark lines, obscuring portions of their spectra, that a peculiar color prevails in them; while a fourth class, of a still lower temperature, are still more obscure. Next come the dark globes, so cool that they have no light of their own, and cannot be seen except when they are so near to a luminous star as to shine by reflected light. This is the case with most of our planets, as well as with we do not know how many, perhaps much larger, darker bodies, floating in the infinity of space, and to which the disappearance and reappearance or changes in luminosity of some stars are ascribed, these phenomena taking place when their light is intercepted by an intervening dark body.

Secchi has just published some of his recent observations on Coggia's comet. He combined the spectroscope and polariscope with his telescope; the spectroscope showed that there were two spectra, one continuous, and the other consisting of luminous bands, agreeing with those of oxide of carbon; while the polariscope showed that the latter spectrum was original light, while the continuous spectrum was reflected light, also showing that the latter came from the direction of the sun: consequently that the continuous spectrum was reflected sunlight. He proved thus that this comet shone not only with reflected sunlight, but by its own light also, thereby revealing the nature of its original luminosity. This is an instance of the highest degree of refinement as yet obtained in modern astronomical research.

SAMSON OR SOLOMON?

This is the muscular period of the year, the time at which the collegian suddenly wakes up to the fact that poring over books, or the clerk to the idea that too close a confinement in the counting room, is resulting in flaccid biceps and a general depreciation to physical tone. One cannot pick up a newspaper now-a-days without being informed that this or that college crew is busily preparing for a coming regatta, or that some enthusiastic individual is training to walk an incredible distance in an equally incredibly brief space of time; while there is even an *on dit* fluttering about that the elegant Mr. Blank, so refined and so gentle in society, actually nightly pummels a professional pug, or stands manfully up and allows his sconce to be soundly rapped or his nose to be painfully abraded by his short-haired tutor.

They say abroad that we Americans make the pursuit of pleasure an elaborate business transaction; we do even more in the way of athletic culture, for we contrive to convert such sport not merely into a business, but too often into a kind of martyrdom.

"Well!" we can hear the reader exclaim, "does this paper, which fairly bristles with health axioms, and which preaches sanitary measures year in and year out, propose to take ground against healthy exercise? Does it argue that gymnasiums are pitfalls, and race boats and ball grounds only so many roads leading to bodily destruction?"

No! not by any means, gentle reader; on the contrary, we think physical exercise a physical necessity—but, in moderation. And there's the point which, it seems, can never be rendered keen enough to penetrate the brain of the average "muscular Christian." Let us illustrate: Suppose two men of equal strength enter for a contest—say a race with single sculls—to take place a year hence. One individual depends on future training, and lets the subject escape his attention until three months or so before the appointed time. Then he abandons books or business and goes to work. He radically changes his diet; from lazy inactivity, he subjects his body to severe strains, and, in brief, endures all kinds of privations in order to work himself into fit condition. The other person starts at once with a little gentle exercise, which in nowise interferes with his regular pursuits; he maintains his generous diet, and in general, save, perhaps, a slight augmentation of muscular work as the time grows short, his mode of life is the same at the end as at the beginning. In the hour of trial it would be found that the first could make "spurts"—momentary efforts of herculean strength—but that the second would show that steady uniform labor which would tell in the end. We should expect to see one man leave his boat collapsed, and in "condition" fit only for the sick room; but the other, we are certain, would step ashore, warm and tired to be sure, but with eye as bright, nerves as steady, pulse as regular and head as clear as when he took up the oars. From the result, any one would say that the first man's course had been wrong, and yet it is precisely the course of thousands of young men just at the present time

It is the same with mental labor. The merest tyro of a scholar knows that no information is so fleeting as that acquired by cramming for some special occasion; while none is so enduring as that gained by slow plodding, inch by inch. Moreover, these sudden transitions from inactivity—for there is hardly any period when the body is more sluggish than in the spring—to intense activity are hurtful, permanently so in some cases. It is well understood that one set of muscles cannot be developed by excessive work without a general weakening of the rest; and if feeble hearts or lungs be included in the organism, this weakening cannot be withstood, and irreparable injury may easily result. A strong frame does not imply a strong constitution; and nothing is truer than that the ultimate strength of the human system, like that of any mechanical structure, is only equal to that of its weakest part. The early deaths of Heenan the prize fighter, Renforth the oarsman, and of a dozen other magnificent specimens of physical development, which we might name, are common examples in point.

A well known professor told us, not long since, that every man of a college crew, which had covered itself with the laurels of victory in a great race, had failed in his studies. The time, in that particular instance, necessary for the severe training was taken from the hours of scholastic work, and the natural result followed. This only adds further proof to the assertion that there is a metaphorical antagonism between brains and muscles; and it leaves open to us the question of which we propose to consider the better type of humanity, him of big muscles or him of well balanced, powerful brain. We once saw a renowned athlete strip, and we looked with admiration on the great knotted fibers which lay beneath an unblemished skin, soft as any woman's, and on the feats of strength impossible to ordinary men. We admired that man's muscles; we thought of them as beautifully made mechanism; we simply admired them. But it was with a very different feeling that we listened to the eloquent words of a great lawyer summing up a great cause the other day. The highest triumph of one man had been to move vast weights; of the other, to stand as the representative of a nation molding the judgment of the loftiest tribunal the world has ever known. Which is the higher ambition?—and yet this renowned lawyer would physically be classed as of the lowest grade. The stooping shoulders, the contracted chest, and the spare muscles have offered no obstacles to his ascent of the topmost pinnacle of that temple of human fame wherein the strong man has but an instant's and the lowest place.

We do not argue against physical culture; but we say that it never should displace or rise superior to that of culture of the mind. It is not to the smith who wields the massive hammer, or handles great bolts of metal, that the world is indebted for the grandest results of inventive skill; but to the quiet, patient student who thinks, and whose thought brings forth that soul which animates arms of steel and iron, to do his bidding. Victory does not now perch on the banners of the nation whose army is composed of the strongest men or whose hosts are the most numerous; but on the standards of that land among whose children the genius of invention, the power of thought, most widely dwells. Brains rule this world—not muscles.

SCIENTIFIC AND PRACTICAL INFORMATION.

DISCOVERY OF THE PHYLLOXERA REMEDY.

M. Dumas recently announced to the French Academy of Sciences that a mode of treating vines attacked by the phylloxera had been discovered, which is certain in its results in destroying the insect and in restoring the vine to health and fecundity. The remedy is the combined employment of sulpho-carbonate of potash, which kills the insect at any depth, to the soil, and of potassic, ammoniacal, and sulphureted manures. *Les Mondes* states that M. Dumas himself is the fortunate discoverer, though his announcement to the Academy was not made until after his process had been tried by exhaustive experimenting by the commission appointed to examine into the various plans submitted. This being the case, M. Dumas becomes the possessor of the $60,000 reward, beside the numberless other prizes of smaller sums offered throughout France.

A NEW SOURCE OF MAGNETISM.

M. Tommasi states that, when a current of steam under a pressure of 5 or 6 atmospheres is driven through a tube of copper 0·08 to 0·12 of an inch in diameter, rolled in a spiral about an iron cylinder, the latter becomes so highly magnetized that an iron needle, placed at a fraction of an inch from it, is strongly attracted and remains magnetized during the passage of the current.

HOW TO KEEP MEAT FRESH A LONG TIME.

We have for authority the *Inter-Ocean* for saying that the following recipe is worth the subscription price of any newspaper in the land:

As soon as the animal heat is out of the meat, slice it up ready for cooking, Prepare a large jar by scalding well with hot salt and water. Mix salt and pulverized saltpeter in the proportion of one tablespoonful of saltpeter to one teacupful of salt. Cover the bottom of the jar with a sprinkle of salt and pepper. Put down a layer of meat, sprinkle with salt and pepper, the same as if just going to the table, and continue in this manner till the jar is full. Fold a cloth or towel and wet it in strong salt and water, in which a little of the saltpeter is dissolved. Press the cloth closely over the meat and set in a cool place. Be sure and press the cloth on tightly as each layer is removed, and your meat will keep for months. It is a good plan to let the meat lie over night after it is sliced, before packing. Then drain off all the blood that oozes from it. It will be necessary to change the cloth occasionally, or take it off and wash it—first in cold water—then scald in salt and water as at first. In this way farmers can have fresh meat the year round. "I have kept beef," says the writer, "that was killed the 12th of February, till the 21st of June. Then I packed a large jar of veal in the same way during the dog-days, and it kept six weeks."

INSECT AESTHETICS.

L. G. Fellner states that the large red ants of Arizona Territory adorn their dwellings with stones, shells, etc. "I have often disturbed their piles in order to find garnets, etc. The ant on guard would then regularly call out an army of miniature warriors, whose attacks I had to avoid. As I stirred one pile with a stick, the guard ran inside; but instead of returning with a number of angry ants, he brought out a large clear garnet and rolled it down towards me; I kept stirring until he had brought five, when I thought the sagacious animal had been taxed sufficiently."

LAND DRAINS.

An excellent subsoil drain may be made by digging a trench and filling in the bottom with sticks of wood, compressing them together with the feet and then covering them with the mold. The effectiveness of such a drain will endure for several years, and the final decay of the wood will serve to enrich the soil.

MAGNETS FOR ELECTRO-MOTORS.

Magnets or armatures for electro-motors may be softened as follows: Heat the iron to an even dull red heat all over; and if the surface of the iron has not been faced off in a machine, lightly file it to remove the scale, and then immerse it in common soft soap, allowing it to remain therein until it is quite cold. Then reheat the magnet to an even red heat whose redness is barely perceptible, and bury it in pulverized lime, wherein it must also remain until quite cold, when the metal will be found as soft as it is possible to make it, and the blade of an ordinary penknife will cut it. At the second heating the iron will emit a light blue flame, showing the effect of the immersion in the soft soap. The conductibility of the magnet may be, by this process, very much increased.

Siam at the Centennial.

His Majesty the King of Siam, having accepted the invitation of the United States Government to take part in the International Exhibition at Philadelphia next year, has appointed J. H. Chandler, Esq. as Royal Commissioner. Mr. Chandler is a native of Pomfret, Conn. He has resided in Siam about thirty-two years past, and is well acquainted with the productions and resources of the country. His early labors in that country were devoted to type-founding, printing, bookmaking, and the introduction of various improvements. He has the honor of having introduced steamboats, and also steam machinery for manufacturing purposes, beside numerous labor-saving machines to facilitate and improve the mechanic arts. Nearly all the early improvements which have done so much for the country were introduced by him. For the last twelve years or so, he has devoted himself mainly to the language, teaching, etc., and has for a long time held the position of chief government translator in the foreign office. He was tutor to His Majesty before his first coronation. With Mr. Chandler for Commissioner, and the readiness with which the King and his ministers have entered upon the work of preparing and forwarding the productions of the country, it may be expected that the kingdom of Siam will make a good display at the International Exhibition.

Sailing of the New Arctic Expedition.

The new British arctic expedition, for polar discovery, comprising two vessels, sailed from Portsmouth on the 29th of May. The expedition is commanded by Commodore Markham, in the Alert, while Captain Nares, navigator, sails the Discovery. Both vessels were prepared and equipped in the best possible manner, with all the appliances for safety and success which arctic experience could suggest.

The route is up the west coast of Greenland, on the same track as the Hall expedition. Special preparations have been made for sledge expeditions, and the explorers are bound to reach the north pole this time, unless ice or other obstacle prevents.

Adulteration of Linseed Oil with Cod Liver Oil.

According to the foreign pharmaceutical journals, linseed oil is now frequently adulterated with cod liver oil. To detect this adulteration, 10 parts by weight of the oil is mixed with 3 parts by weight of commercial nitric acid in a glass cylinder, and well mixed by stirring with a glass rod. It is then left quiet until the oil and acid separate. If cod liver oil is present, the layer of oil will have a dark brown or black color, and the acid will be orange yellow or yellowish brown. Pure oil treated in the way is at first a water green, then a dirty yellowish green, and the acid takes on a brighter yellow color.

RAPID TRANSIT IN LONDON.—Recently, during one day, Whit Monday, 246,547 passengers were carried on the Metropolitan Underground Railway, London, being at the rate of ninety millions of passengers per annum. The stations are half a mile apart. The trains run every two minutes; they consist of twelve cars each, and are drawn by locomotives weighing forty-five tuns each. They discharge and take up a load of passengers, run to the next station, and stop, all within the space of two minutes.

MR. JAMES T. GARDNER, Chief Geographer of the Geological and Geographical Survey of the Territories, with his staff, left New York on May 26, and will have head quarters until October at Denver, Col. Ter

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THE FIRELESS RAILWAY SYSTEM IN ENGLAND.

We publish herewith engravings of a new form of fireless car, the design of an engineer named Todd. It is a "dummy," or combined car and locomotive; it is styled the Harmless, and is constructed thus: There is a main lower frame 22 feet 6 inches long over the buffers, 7 feet wide over all, and 3 feet high from the rail to the top; and on this frame is placed the 14 feet body of an ordinary car. In the center of the frame are two receivers, each containing 30 cubic feet of water. Below the buffer beams are screw couplings and stop valves with perforated pipes running right through the receivers. The wheels are 24 inches diameter, placed 4 feet 6 inches between centers. Cylinders, 9 inches diameter and 8 inches stroke, surrounded with large jackets open to the water of the receivers. At each end of the car, outside the dash plate, is placed a brake handle, and on either side of this a regulator and reversing handle, all arranged as shown. These latter handles fit into spring sockets, so as to be changed from one end to the other, principally to prevent any one from behind moving the car. There are four sand boxes, with handles brought to the foot boards. There are two exhaust pipes, the end of each projecting slightly upwards from the edges of the curtains over the foot boards; and by a cock the waste steam is turned into whichever pipe happens for the time to be at the following end of the car. All the working motion is quite protected from dirt by light boxes which have hinged doors at the sides.

The inventor proposes to start the engine on its journey with an initial pressure of 200 lbs. to the inch; and the *Engineer* states that, owing to the jacketing of the cylinders, the loss by radiation will not exceed 5 lbs. pressure per hour, allowing the engine to run 40 miles on level lines at one charging of the boiler. This is rather a large idea of the capabilities of the system; and we hope that it may be realized.

Fig. 1 is a transverse section of the car, showing the boiler and steam dome, and the position of the engine; Fig. 2 is a longitudinal section of the same; and Fig. 3 is an exterior elevation, also showing the stationary boiler from which the apparatus is charged.

Fig. 1.

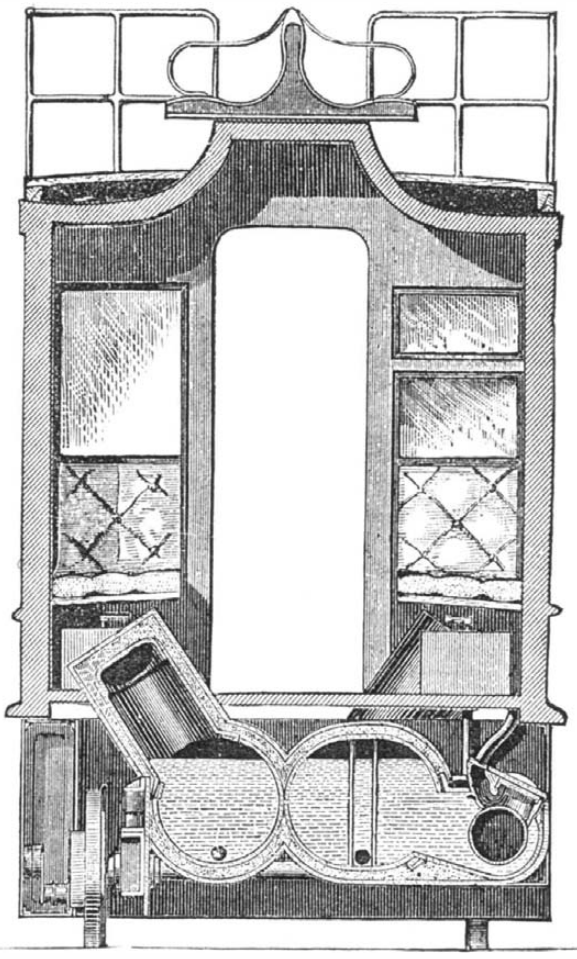
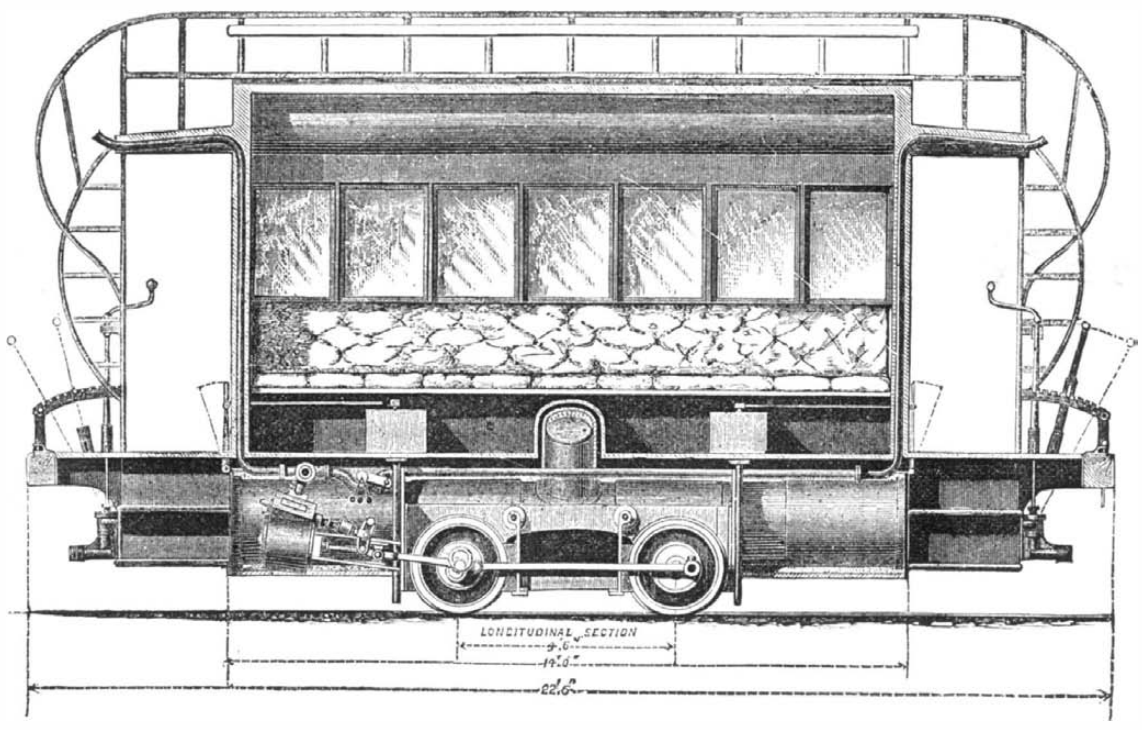


Fig. 2.



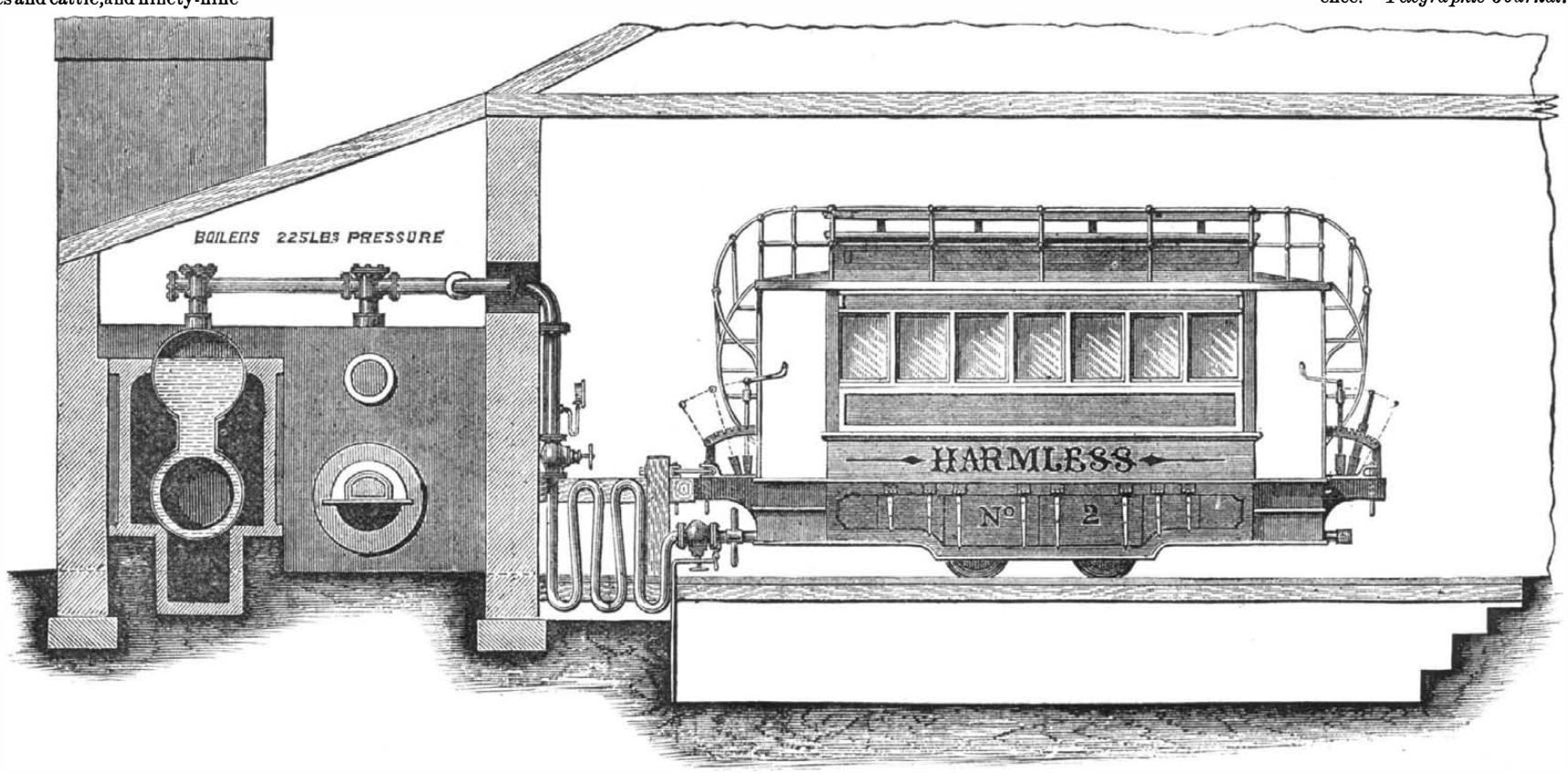


Fig. 3.—TODD'S FIRELESS STEAM CAR SYSTEM.

Lightning.

There are indications that we may anticipate severe electrical disturbances during the coming summer. The winter has been unusually long and severe. Abnormal weather has occurred over most parts of the globe. Reports of severe thunderstorms reach us from the Cape and the antipodes. Exceptional conditions of this kind abroad usually presage similar conditions in England. "Coming events cast their shadows before." But whether the coming summer be above or below the average, we are bound to call attention to the fearful apathy and gross carelessness evinced in not protecting buildings from atmospheric electrical discharges.

During two severe storms in England, in June, 1872, there were ten deaths and fifteen cases of injury to human beings; sixty houses struck, and fifteen burnt down; and twenty-three horses and cattle, and ninety-nine sheep, killed. Those accidents that are not recorded are innumerable. In large towns damage to property is more frequent than destruction of human life; but in the open country, destruction of life is perhaps more frequent than destruction of property, unless we except trees, which are ruined in thousands every year, and unfortunately—from their size and growth—the finest suffer.

Lightning protection is therefore not only a necessity, but it is a source of satisfaction and comfort. It is difficult to comprehend the reasons why it is not more largely adopted. It is not its inutility—for the beneficial effect of lightning conductors among our buildings and our shipping is incontestible. It is not its expense—for a house can be protected for a less sum of money than is required to bed out a parterre. It is not its difficulty—for any skilled workman or energetic landlord can do it with ease.

Dr. Mann, the President of the Meteorological Society, has done good service in reading an exhaustive and able paper on the subject before the Society of Arts, and an admirable notice of it was given in the London *Times*. Dr. Mann has supplemented this notice with an excellent letter to the leading journal on the precautions to be taken, especially with the tall zinc tubes now so largely used for chimney tops. Mr. Preece had previously called attention, in the *Times*, to the danger of chimneys, lined as they are with soot, filled with ascending currents of heated air and smoke, and terminated in grates, acting as lightning conductors. If all such chimney pots be connected with the water pipes by galvanized iron ropes, and if all these pipes make good earth (that is to say, have a large metallic surface in contact with the earth), a house is as safe from lightning as a collier in a mine.

All lightning protectors should be constructed on proper scientific principles, and we have published in our columns many valuable papers on the subject. The great desiderata to be urged are the employment of perfectly continuous metallic ropes or rods, the use of good earths, and the termination of the conductors in the air in points. A great fact to be remembered is that joints, and earths, and points deteriorate, and lose their efficiency; they therefore require frequent examination and frequent renewal. Lightning conductors require annual inspection and a careful overhauling. It is needless to point out to telegraphists the necessity of a good earths, for they all know that their circuits are unworkable without them; but it is lamentable to see the condition of the earths to the lightning protectors of the steeples of some of our cathedrals and churches. The splendid new spire of Llandaff cathedral is positively in a dangerous condition from this cause. Nine out of every ten churches are in the same condition. Earth wires are plunged into the interior of cisterns; they are leaded into stones; they are bedded in dry sand. One was carefully put into a glass bottle buried in the dry earth; another was coiled carefully into the interior of a wooden pail, in the basement floor of the house it was meant to protect. Every case of the inefficiency of lightning protectors that has been examined has been proved to be due to gross ignorance of the principles of electrical science.—*Telegraphic Journal.*

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STENOGRAPHY BY MACHINERY.

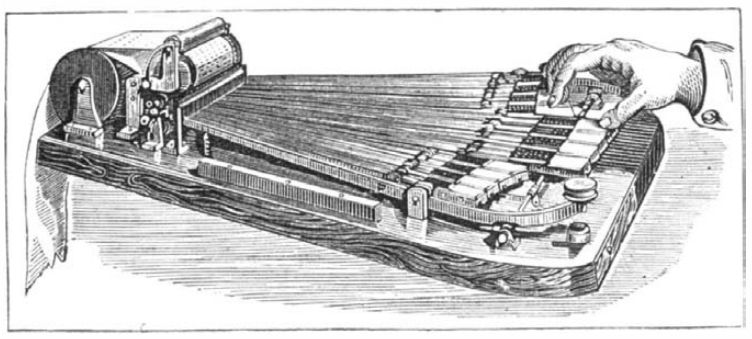
A curious apparatus has recently been invented in France, by the aid of which stenographic writing may be accomplished at the rate of from 200 to 250 words per minute, which is probably as fast as the language can be spoken by the readiest speaker. The device, an engraving of which is given herewith, consists of a keyboard operated as shown by the hand of the reporter, and composed of twelve black and an equal number of white keys. On each side of the instrument is a large key moved by a pressure of the wrist, and serving to give supplementary signs which simplify the reading of the characters printed.

All the keys, when operated, produce indications in ink on a roll of paper, which is taken from a reel in manner similar to that on the Morse telegraphic apparatus. The black keys, however, give long marks, while the white ones cause simple dots to be transcribed. At each pressure of the fingers on the keyboard, the paper is automatically unrolled for about 0·02 of an inch, so that on each line any combination of twelve double signs may be imprinted, and these signs are arranged in three groups of four each, and read from left to right in the ordinary manner.

The number of characters which may be made on each division of four is more than sufficient to to require a single movement to form a single letter. In other words, with practice, three letters or less can be written at once. If the useless letters be suppressed, such as double letters, e mute, etc., frequently a single movement will produce an entire word. In case, however, the word is to be continued to the next line, a movement of one of the wrist keys makes a character indicating the fact.

The manipulation of the keyboard requires great skill. Learning to read the characters is very easy, but at least six months' practice is necessary for one to become an expert operator capable of following every word as it is uttered in a large assembly.

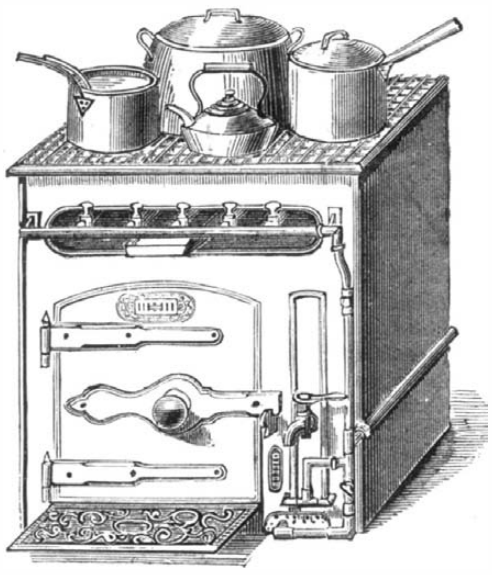
The paper roll is of no great length. About sixty or seventy feet, four inches in width, is required for an hour's continuous writing.



STENOGRAPHIC MACHINE.

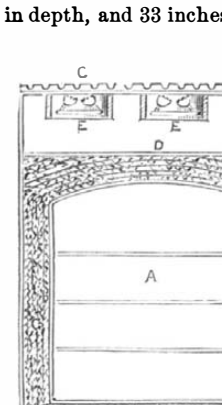
COOKING BY GAS.

We publish herewith engravings of a gas-burning cooking stove, the invention of B. Giles, Blackheath, England, who



claims to have succeeded in cooking the most delicate dishes without their imbibing the slightest flavor from the products of combustion.

Fig. 1 is an isometrical view of the small sized apparatus, in which, it will be seen, great attention has been paid to compactness and neatness in working out the design. The outside dimensions are 22 inches in width, 16 inches in depth, and 33 inches in hight. By a reference to Fig. 2 (a diagram of a transverse sectional elevation of the whole kitchener), it will be seen that the oven, marked A, is surrounded by a chamber. This chamber, marked G, is filled with coils of thin iron, except where room is left for the burners, marked F, which heat the oven and the water in the boiler, B. Over the burners, F, is a grating, marked I. This grating, which supports the coils of thin iron, is placed at a hight sufficient to allow of the gas burning to advantage for developing heat. The heated products of combustion from the burners, passing through the grating, circulate freely among the coils of thin iron, and pass out at the point, K, after the coils of iron have absorbed and utilized the greater part of the excess of temperature of the products over the atmosphere. By the adoption of this system the heat is kept uniform, and is the more equally distributed over the whole surface of the oven. The space, D, constitutes a most effective plate warmer. Over the oven gas burners, E, are placed in sets of four, for the purpose of heating digesters (for making soup), fish kettles, saucepans, etc. Each set (as with those for heating the boiler and oven) is so arranged as to thoroughly consume every particle of gas, and generate the maximum amount of heat possible. Each



set of these burners for heating saucepans consumes about eight cubic feet per hour when the gas is turned full on; the heat thus evolved will raise the temperature of a gallon of water from that at which it is usually delivered to that of the boiling point of water (212° Fah.) in about thirty minutes, with a consumption of about four cubic feet of gas.

THE ALEXANDRA.

The launch of the twin screw ironclad Alexandra on April 8 adds to the British navy the finest and most powerful broadside ironclad in the world.

The principal dimensions are: Length between perpendiculars, 225 feet; breadth, extreme, 63 feet 8 inches; depth in hold, 18 feet 7⅝ inches; tunnage, 6,049; displacement, 9,492 tuns; draft forward, 26 feet; draft aft, 20 feet 6 inches; indicated horse power (intended), 8,000; speed, 14 knots.

Like all her predecessors of modern type, the Alexandra has her water line protected by a belt having a maximum thickness, over the water line, amidships, of 12 inches, a thickness which, in masted ironclads, has been equaled as yet only in the French vessel Redoubtable, in the Independencia (Brazilian ironclad, whose launch was so unfortunate), built in England from Mr. Reed's designs, and in the Kaiser and Deutschland, built and building there—also from Mr. Reed's designs—for the German government. Towards the ends the belt tapers to a much less thickness, an inevitable defect of the belt system, to which it does not appear to be customary to attach much importance, though its existence is to our mind the great argument in favor of making the ends into coal tanks, which, being penetrable with absolute impunity to the ship, solves all questions of thickness of armor by enabling the designer to dispense with it altogether.

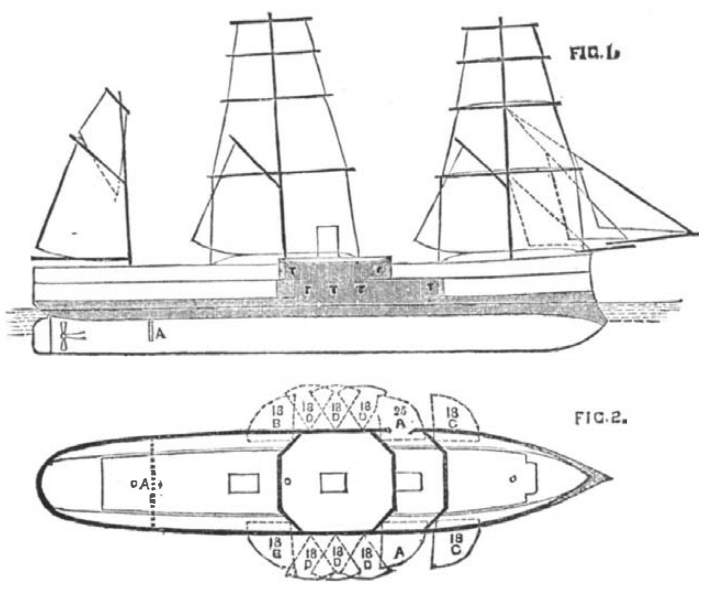
The Alexandra is a central battery ship in the best sense, that is, she needs no bow or stern batteries to give her end-on fire. For the first time the English navy really has a masted ship with satisfactory all-around fire (which even the Monarch turret ship has not), for out of twelve guns the new ironclad can fire four (including the two heaviest) straight ahead, and two straight astern. On each broadside from four to six guns can be fought, according to the bearing of the enemy. The Alexandra, by virtue of her two-gun decks with end-on fire from both, thus approximates very closely, as regards range of fire, to an ideally perfect broadside ship.

Splendid ship as she is, and advantageously as she compares with other broadside ships in the English or any other navy, the Alexandra shows in places, says *Engineering*, that deficiency of protection which is always observable in vessels of her type. Thus the batteries are armored with only 8 inch and 5 inch armor—the latter a miserable defense against the guns of other ironclads The reason of course is that the ship must, before all things, be kept above water. There is much to be armored, and not much to do it with; and when the waterline is fairly secured, the batteries are left, to say the least, very unequally protected.

It should be noted that in the Alexandra, as in previous ships built on the two-deck battery system, the upper battery serves as a conning tower, and enables that weight to be dispensed with. It will be seen by Fig. 1 that the armor forward is carried down over the ram, both to strengthen the latter, and to guard the vitals of the ship from injury by raking fire from ahead, at times when waves or pitching action might expose the bows. The magazines, engines, etc., are similarly protected against a raking fire from abaft by a hanging bulkhead, A, across the hold, plated with 5 inch armor.

The sills of the main deck ports are 9 feet, and those of the upper deck ports more than 17 feet, above the water. The total weight of armor and backing is 2,350 tuns, and of guns and ordnance stores about 660 tuns.

The only defect of the Alexandra appears to us to be that she is too good. She is too large a version of the type. A small Alexandra, that is, an improved Audacious, would appear to us a valuable addition to the navy, well fitted for certain necessary services for the discharge of which such masted broadside ships are probably as well fitted as, or even better fitted than, masted turret ships. But if so much money was to be spent, it should have been spent upon an Inflexible, or even upon a Devastation.

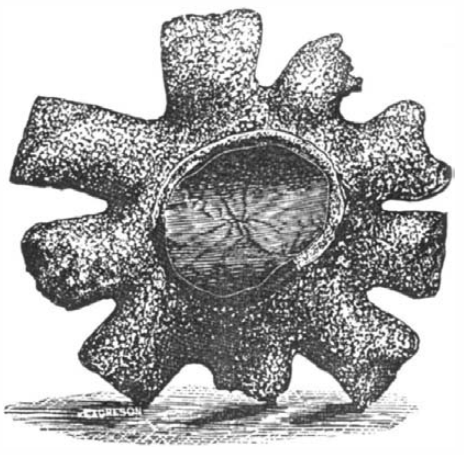


THE ENGLISH IRONCLAD ALEXANDRA.

BRACHIOSPONGIA.

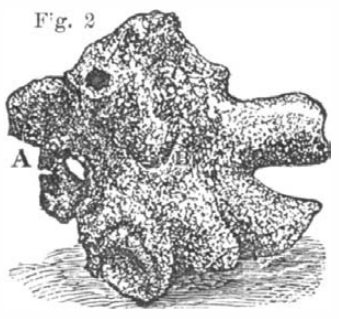
"During a geological trip in 1855, I discovered a new genus of fossil sponge, which may be worthy of a brief notice. My first specimen was exhibited to Professor L. P. Yandell, of Louisville, Ky., and while in his hands it was seen and described by Professor D. D. Owen. (Second Report of Geology of Kentucky, page 111.) He styled it an amorphozoon, and suggested the name of *scyphia digitata*. I doubt if he ever saw the fossil in place, though he correctly refers it to the birdseye group of the lower silurian. It was again described and imperfectly figured by Professor R. Owen. (Indiana Geological Survey, 1859–60. pp. 362, 363). He changed the name to *syphonia digitata*, and he recognized it as a sponge. The specimen thus described, having nine arms, I claim as my discovery, and it should be acknowledged as typical of the genus. Professor S. S. Lyon afterwards found one with eleven arms, of which casts have been

Fig. 1.



widely distributed. In 1867 I placed my original specimen in the hands of that accomplished naturalist, Professor O. C. Marsh, of Yale College, for a more careful examination. The result was the rejection of the former unsuitable names and the substitution of *brachiospongia* (the arm-bearing sponge), with the specific name of *Roemerana*, in honor of Professor F. Roemer, the leading authority on palæozoic sponges. Over fifty additional specimens, complete or fragmentary, were obtained by me on a subsequent visit to Franklin county, Ky., and a map of the sponge region was prepared. Specimens have also been found in the same geological horizon

Fig. 2



in Tennessee. Allied forms were likewise found, but they were so highly silicified and distorted as to make an accurate description impracticable. Professor Marsh's notice appeared in the *American Journal of Science and Arts* (vol. 44, p. 88), and it was afterward corrected and elaborated in the form of a paper read before the American Science Association in 1868. Fig. 1 represents *b. Roemerana.*

The general appearance of the *brachiospongia* is vasiform; a central cup, oval, with a rim one or two inches high, being surrounded by tubular arms or fingers, hollow at the base, and closed at the extremity. These arms vary in number,

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from five to twelve; and on this variation specific distinctions are founded. The smallest sponge of this kind thus far found is three inches in diameter, and the largest twelve inches. Frequently the fingers were found detached from the body; and in one case two large ones were found near each other, having so grotesque a resemblance to a pair of diminutive feet that for a time my assistants positively refused to aid me further!

The exterior of the *brachiospongia* is silicified, while through the interior characteristic silicious spicules are distributed. Near the center of the base, and opposite the mouth of the cup, is a small papilliform cone, which others have regarded as the point by which the sponge was attached to its support. But, in my opinion, this is a hasty conclusion; and I think it can be shown that this basal protuberance is the remnant of a partially absorbed arm. In a specimen of *b. Hoveyii* (Marsh), having twelve arms, only six of which appear in the illustration (see Fig. 2), there is evidence that the sponge arms, though constant in their specific numbers, were at intervals liable to alternate absorption and reproduction. The arm, A, seems to be the youngest in a series of which the basal cone, B, is the retiring member. A more careful study of these curious and highly interesting fossils may serve to throw light upon the mysterious laws of spongoidal growth."—*Rev. Horace C. Hovey, M. A.*

Correspondence.

The Blair Direct Process.

To the Editor of the Scientific American:

From a proof copy of the very interesting paper read on the 6th of May last before the British Iron and Steel Institute by their distinguished late President, Mr. Isaac Lowthian Bell, upon his visit to the mines and iron works of the United States in the fall of 1874, I make the following extract. Mr. Bell says, on page 47:

"My friend Mr. T. S. Blair, in company with other gentlemen, has erected a work near Pittsburgh for carrying his mode of making steel into practice. * * Mr. Blair's method consists in deoxidizing iron ore and melting the iron sponge so obtained in an open hearth with pig iron." On page 48: "Mr. Blair claims great advantages for his apparatus in saving of fuel. * The difficulty which besets this and all other modifications of dealing with iron in so fine a state of division as it exists in the sponge is its proneness to oxidation. Hitherto, it seems to me, the direct process, as it is termed, has met with the most success at Landore. The pig iron, after being melted, has blocks of ore thrown in; the carbon and silicon of the bath reduce the oxide, and the metallic iron is instantly taken up by the bath of liquid metal. Very different must be the action on sponge, which, when thrown into the furnace, will float on the melted pig, and, being exposed to carbonic acid at a very high temperature, will to some extent infallibly be re-converted into oxide. So far as I was able to learn, 2 parts of pig iron and 1 of sponge lost about 20 per cent in the furnace. Now if it be true, as I have heard it stated, that a mixture of wrought and pig iron can be fused in an open hearth with a loss of 6 per cent, it follows that a considerable portion of the sponge used in Mr. Blair's process must be re-oxidized. The specimens of steel I had the opportunity of examining indicate entire success so far as a mere question of quality in the product is concerned. There seems to be no doubt that, in obtaining the sponge iron, Mr. Blair has made a notable step in advance of M. Chenot; and I am far from wishing to be understood as expressing an unfavorable opinion on the future commercial merits of the scheme."

As one interested with Mr. Blair from the beginning in the carrying out of the mode of making iron and steel by the direct process, I would respectfully ask that you publish this communication, which seems necessary as an explanatory appendix to that portion of Mr. Bell's paper which relates to the Blair process. We had the pleasure of a long visit from Mr. Bell in October last, nearly all of his time, during his three days in Pittsburgh, having been spent with us. Our books, showing the exact amount in pounds of every component of each charge, and the resulting product in pounds of every cast of steel made by us from the beginning, were thrown open to him and were freely and fully inspected, as well by himself as by his son, Mr. Charles Bell, who assisted him in his observations. Every facility which any of ourselves enjoyed for seeing or knowing what was being done in and about every department of the works was cheerfully given him, our object (aside from showing deserved courtesy to so distinguished a stranger) being to enable him to criticize our operations with full knowledge of their details. While Mr. Bell says "so far as I was able to learn," his means of knowing the exact facts were as ample as Mr. Blair's or my own. He saw that, never at any time, even for experimental purposes, had we made a cast of "2 parts pig and 1 part sponge." In point of fact, as we never did use pig in anything approaching the above proportions, neither Mr. Bell or any of ourselves know what the loss would be.

For the week in which Mr. Bell's visit took place, the average quantity of pig metal used (in 11 casts) was $25\frac{17}{100}$ per cent of the total weight of material charged into the furnace; and the last cast inspected by Mr. Bell, and made on the Saturday, was composed of $19\frac{3}{10}$ per cent pig, $53\frac{4}{10}$ per cent sponge, $18\frac{3}{10}$ per cent scrap steel from our own steel, and 9 per cent spiegeleisen. A tabular statement was taken off from the books, which Mr. Bell took with him, of casts made from the beginning (inclusive of the time when we were battling with the difficulties incident to working a new and different melting furnace from that of Mr. Siemens, Mr. S. having at that time refused to allow us to use his furnace unless we abandoned iron sponge, which he himself was then trying to make). This statement shows that, of 691,883 lbs. of the different metals charged into the furnace, $33\frac{32}{100}$ per cent consisted of pig metal; and the amount of steel made was 589,070 lbs., showing a loss of $14\frac{86}{100}$ per cent.

The direct process at Landore, to which Mr. Bell refers, is that of Dr. C. W. Siemens. Dr. Siemens uses the ordinary open hearth furnace (not the rotator), and the steel is good enough for railway rails, and is used for that purpose, 1,000 tuns of rails per week being about the average product.

The materials consumed in making 2,240 lbs. of steel in the ingot amount to 2,961 lbs. on the average, and consist of 1,517 lbs. Bessemer pig, 197 lbs. spiegeleisen, 706 lbs. scrap steel, 541 lbs. ore (60 per cent). Mr. Bell correctly describes the operation thus: "The pig iron, after being melted, has blocks of ore thrown in. The carbon and silicon of the bath reduce the oxide, and the metallic iron is instantly taken up by the bath of liquid metal." He, however, adds: Very different must be "the action on sponge, which, when thrown into the furnace, will float on the melted pig; and, being exposed to carbonic acid at a very high temperature, will, to some extent, infallibly be re-converted into oxide."

When Mr. Bell was at our works he witnessed the fact that the iron sponge, when thrown into the furnace, did not float on the melted pig; and as it plunged and remained under the surface protected by the covering of the slag, it was not exposed to the highly heated carbonic acid, and was therefore not oxidized to an undue extent. This remarkable and interesting fact was noticed and commented on with much pleasure by Mr. Bell at that time, as it had previously been a source of satisfaction to ourselves, controverting, as it did, the theory of all and the experience of most parties.

If you will permit me, I will remark that, if Mr. Siemens would first convert his 60 per cent ore into iron sponge, and make it the principal ingredient of his charge (instead of the highly priced and more deleterious pig metal), his ingots would cost him less per tun; and instead of being useful only for rails, it would command $25 per tun more and could be used (as the Blair steel is) for all purposes, from homogeneous metal up to tool steel.

My object being, however, to make some necessary corrections of errors in the document of Mr. Bell, I ask you to give this communication the same publicity you do that paper.

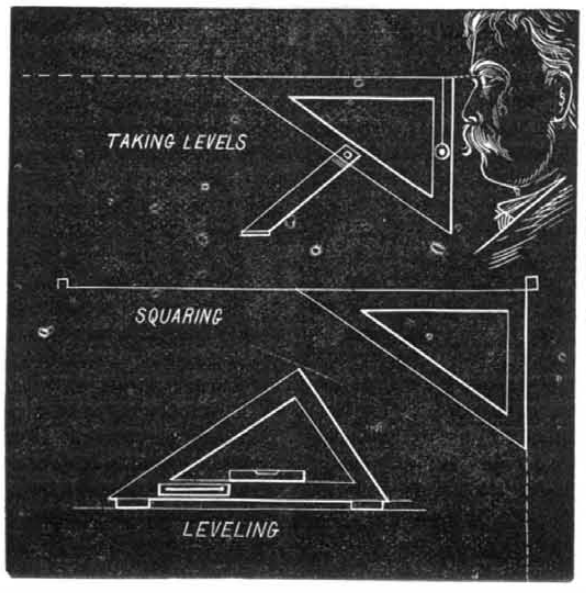
MORRISON FOSTER, Vice President.

Blair Iron and Steel Company, Pittsburgh, Pa.

A Simple Surveyor's Instrument.

To the Editor of the Scientific American:

I send you a diagram of a cheap and useful instrument, for the use of those who have ditching and leveling to do. Farmers and builders often need a ready means of taking levels and adjusting perpendicular and horizontal surfaces.



The hypothenuse of the triangle is conveniently made $7\frac{1}{2}$ inches long, the other sides being $4\frac{1}{2}$ and 6 inches, respectively. A plummet indicates the correct position of the instrument. It can readily be adapted for leveling horizontal surfaces, by adding a spirit level, as shown in the engraving.

H. C. NAYLOR.

Indianapolis, Ind.

Parasites in Wasp Stings.

To the Editor of the Scientific American:

The other day while I was dissecting a wasp, I took out his sting and found upon it a parasite. It was oval in shape. Its legs had hairs around the joints and around the feet. Its head was small compared with the body. Its *antennæ*, two in number, consisted of two joints; from the end projected two hairs as long as the other part of the antennæ. Its color was white. If among your readers there is any one who can inform me concerning this parasite, I would be very glad to hear from him.

Plainfield, N. J. W. D. M.

The Miner's Respirator.

To the Editor of the Scientific American:

As a respirator for miners, I propose a thin rubber mask, which would cover the nose and mouth, fitting so as to exclude all external gases. I further propose to have on the mask, in place of a nose, a rubber tube which would communicate with a leathern vessel, resembling in appearance a knapsack, to be strapped to the shoulders. This leather vessel should contain a mixture of the gases oxygen and nitrogen, which would be conducted to the nostrils by the tube. The mask should contain a second tube, to let the exhalation from the lungs escape; and this second tube should have a valve, so that vapors could escape, but nothing enter. In a short time, these gases would be consumed by the miner; and to remedy this, I propose to have large receivers in the vicinity of the workmen, so that the leathern vessels might be replenished with air.

ANNA BLUNT.

58 East 9th street, New York city.

How to Take Observations at Sea during a Fog.

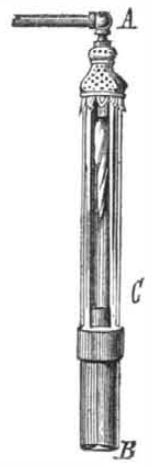
To the Editor of the Scientific American:

Referring to the Schiller disaster, it strikes me that observations could readily be taken from a captive balloon allowed to ascend above the strata of a dense fog.

SUBSCRIBER.

NOVEL GAS APPARATUS AT THE PARIS GRAND OPERA

The magnificent opera house lately completed in Paris, probably the finest structure of its class in the world, contains a number of ingenious and novel improvements in the stage mechanism. The usual mode of illumination by gas in theaters is attended with many disadvantages and considerable danger, from the light scenery catching fire from the exposed flames. The foot lights also are a constant source of peril to ballet dancers wearing inflammable gauzy dresses, while the current of heated air which they generate is especially distressing both to vocal organs and to the eyes. The gas flames in the French opera house are so arranged that the heat is entirely conducted away, while the flames themselves are inclosed in a glass chimney so constructed that, should it break, the gas to the burner is immediately shut off. We give herewith an engraving showing the construction of the burner, in which it will be remarked that the flame burns downward. A is the supply pipe, and B a supporting tube beneath for the chimney, C. Through the tube, B, there is a blast of air driven, which draws down the flame, and, at the same time, effectually prevents the heating of the glass. Should the latter break, the end section of the tube, A, which is hinged, falls, thereby closing a valve and shutting off the supply.



The footlights thus arranged are formed in sets of twelve, and number in all one hundred and twenty. Apparatus is provided whereby any one set or all may be lifted to the level of the stage or lowered beneath.

The Occlusion of Hydrogen by Palladium.

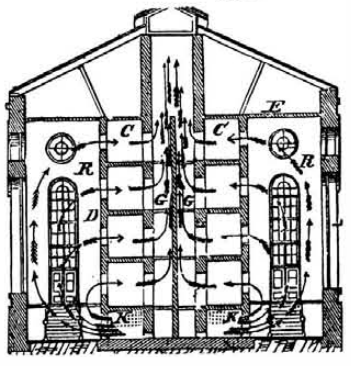
"The well known result of Graham's experiments on palladium, and the large volume of gas absorbed when thin strips of this metal are made the terminals of a rather strong current of electricity, are familiar to all. To demonstrate this fact to an audience or class has only lately been attempted, and I have devised a simple piece of apparatus, which I have used many times and have found to be correct and reliable, if the following directions are carefully carried out: Pure palladium foils, measuring about one eighth of an inch in width and three inches long, are attached to stout pieces of copper wire with hard solder; these are passed through pieces of cork cut square, according to size of tank used.

The strips are first heated in a Bunsen burner and allowed to cool. They are then coated with a thin shellac varnish (ordinary negative varnish thinned with alcohol answers the purpose) on one side only, by means of a camel's hair brush. Care should be taken to prevent the varnish from flowing on the opposite side. The strips are then placed in the lantern tank, about one and a half inches apart, with the varnished sides towards the sides of the tank and parallel to the light. The tank is filled with dilute sulphuric acid, and the wires from a battery of about four one-quart Bunsen cells are connected with the strips.

Decomposition immediately takes place; hydrogen is occluded, producing a powerful contraction in the palladium. By reversing the current, the hydrogen is discharged, and the phenomenon is repeated in the other strip. By these means the strips undergo wonderful contortions. This simple experiment demonstrates the peculiar properties of this metal."—*L. H. Laudy, in the American Chemist.*

IMPROVEMENT IN THE CONSTRUCTION OF PRISONS.

Mr. Alfred B. Mullett, late government architect, has patented an improvement in the construction of prisons, shown herewith, which consists in combining two ranges of cells, C C, with a partitioned or double corridor, G. The heating apparatus is below, and the arrows show the courses of the the air, which passes through each cell, and out through the ventilators, over the corridors, as shown. The arrangement appears to be an excellent one.



ALUM and plaster of Paris, well mixed in water and used in the liquid state, forms a hard composition and is a useful cement.

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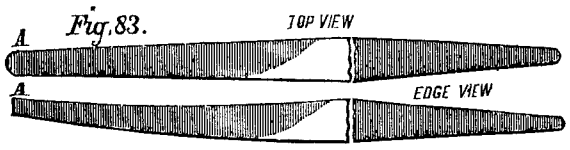
PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NUMBER XXV.

HAND TURNING—BRASS WORK.

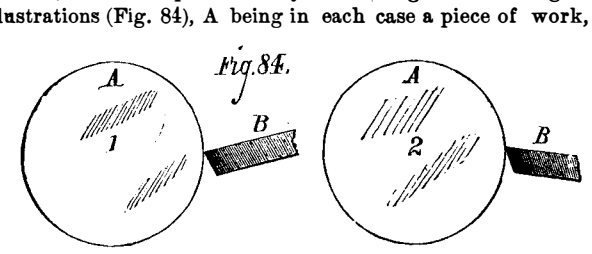
For roughing out brass work, the best and most universally applicable tool is that shown in Fig. 83, which is to



brass work what the graver is to wrought iron or steel. The cutting point, A, is round-nosed. The hand rest should be set a little above the horizontal center of the work, and need not be close up to the work, because comparatively little power is required to cut brass and other soft metals, and therefore complete control can be had over the tool, even though its point of contact with the rest be some little distance from its cutting point. The best method of holding and guiding is to place the forefinger of the left hand under the jaw of the hand rest, and to press the tool firmly to the face of the rest by the thumb, regulating the hight so that the cutting is performed at or a little below the horizontal center of the work. The tool point may thus be guided with comparative ease to turn parallel, taper, or round or hollow curves, or any other desirable shape, except it be a square corner. Nor will it require much moving upon the face of the lathe rest, because its point of contact, being somewhat removed from the rest, gives to the tool point a comparatively wide range of movement. The exact requisite distance for the rest to be from the work must, in each case, be determined by the depth of the cut and the degree of hardness of the metal; but as a general rule, it should be as distant as is compatible with a thorough control of the tool. The cutting end of this tool should be tempered to a light straw color.

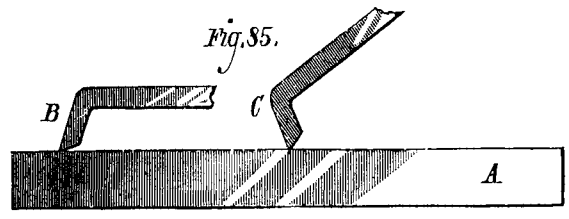
SCRAPERS

To finish brass work, various shaped tools termed scrapers are employed. The term scraper, however, applies as much to the manner in which the tool is applied to the work as to its shape, since the same tool may, without alteration, be employed either as a scraping or a cutting tool, according to the angle of the top face (that is, the face which meets the shavings or cuttings) to a line drawn from the point of contact of the tool with the work to the center line of the work, and altogether irrespective of the angles of the two faces of the tool whose junction forms the cutting edge. To give, then, the degree of angle necessary to a cutting tool, irrespective of the position in which it is held, is altogether valueless, as will be perceived by considering the following illustrations (Fig. 84), A being in each case a piece of work,



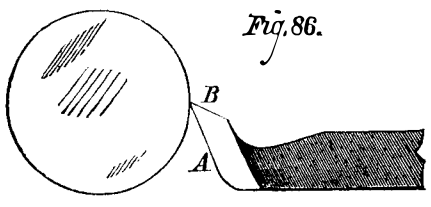
and B, a tool. The tool edge, as applied in No. 1, will act as a scraper; whereas in No. 2 it will act as a cutting tool.

Now let us take a tool applied to flat surfaces, as in Fig. 85, A representing a piece of flat metal. The tool, if applied

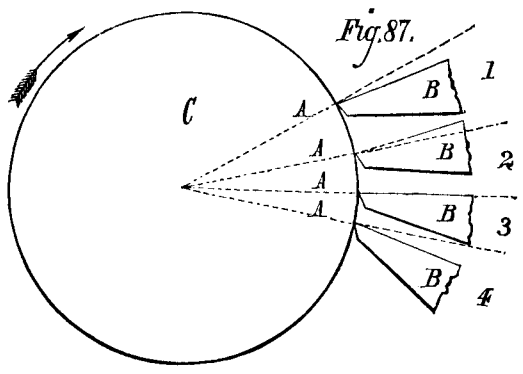


as shown at B, would present a cutting edge, and as shown at C, a scraping edge, to the work, the tool being the same in both cases. The result of attempting to present the cutting edge, as at B, is that it would jar in consequence of the springing of the tool.

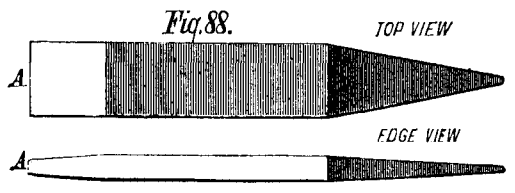
The angle of the back or side face of any tool (that is, the face, A, in Fig. 86), either to the top face, B, or to the work,



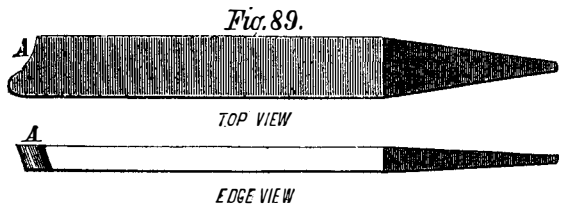
does not in any case determine its tendency to cut or scrape, but merely affects its capability of withstanding the strain and wear due to severing the metal which it cuts. Nor is there any definite angle at which the top face, B, to the work converts the edge from a cutting to a scraping one. A general idea may, however, be obtained by reference to Fig. 87, the line, A, being in each case one drawn from the center of the work to the point of contact between the tool edge and the work, C being the work, and B, the tool. It will be observed that the angle of the top face of the tool varies in each case with the line, A. In position 1, the tool is a cutting one; in 2, it is a scraper; in 3, it is a tool which is a cutter and scraper combined, since it will actually perform both functions at one and the same time; and in 4, it is a good cutting tool, the shapes and angles of the tools being the same



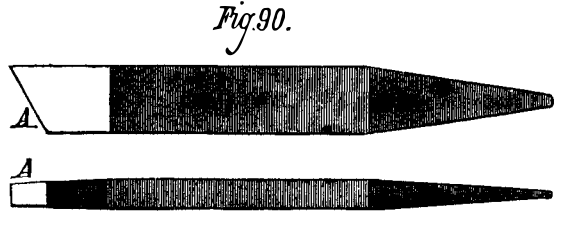
in each case. Fig. 88 represents a flat scraper for finishing brass, A being in each case the cutting edge. Since the tool may be turned upside down, the end of this tool may be and



frequently is ground at an angle, especially in those cases where, for some required purpose, the tool is made of a particular shape, such, for instance, as in the case of the tool shown in Fig. 89, the angle being shown at A. On all brass



work, it is, however, better to dispense with any angle. Fig. 90 represents a scraper (A being the cutting edge) designed



for operating close down to the lathe center or in a square corner such as is formed at the junction of a head or collar upon a shaft or bolt. This tool may also be turned upside down, so as to form a right or left hand tool.

Scrapers will cut more freely if applied to the work with the edges as left by the grindstone; but if they are smoothed, after grinding, by the application of an oilstone, they will give to the work a much smoother and higher degree of finish. They should be hardened right out for use on cast iron, and tempered to a straw color for brass work. If the scraper jars or chatters, as it will sometimes, by reason of its having an excess of angle, as shown in Fig. 89, or from the cutting end being ground too thin, a piece of leather, placed between the tool and the face of the rest, will obviate the difficulty.

Round or hollow curves may be finished truly and smoothly by simply scraping; but parts that are parallel or straight upon their outer surfaces should, subsequent to the scraping, be lightly filed with a smooth file, the lathe running at a very high speed to prevent the file from cutting the work out of true. The file should, however, be kept clean of the cuttings by either using a file card or cleaner, or by brushing the hand back and forth on the file, and then striking the latter lightly upon a block of wood or a piece of lead, the latter operation being much the more rapid, and sufficiently effective for all save the very finest of work. If the filings are not cleaned from the file, they are apt to get locked in the file teeth and to cut scratches in the work. To prevent this, the file may be rubbed with chalk after every eight or ten strokes, and then cleaned as described. After filing the work, it may be polished with emery paper or emery cloth. The finer the paper and the more worn it is, the better and finer will be the finish it will give to the work; for all metals polish best by being rubbed at a high speed with a thin film composed of fine particles of their own nature, as ivory is best polished by ivory powder, and wood by shavings cut from itself. To facilitate the obtaining the film of metal upon the emery paper, the latter may be oiled, to a very slight extent, by rubbing a greasy rag over it, which will cause the particles it at first cuts to adhere to its surface. Emery cloth is the best for highly finishing purposes, because it will wear longer without becoming torn. It should be pressed hard against the work, and reversed in all directions upon it, so as to wear all parts of its surface equally, and to distribute the metal film all over; and the work should be revolved at as high a speed as possible, while the emery cloth is, during the first part of the polishing, kept in rapid motion upon the work backward and forward, so that the marks made upon the work by the emery cloth will cross and recross each other. When fine finishing is to be performed, the emery cloth (or what is better, crocus cloth) should be pressed very lightly against the work and moved laterally very slowly.

Round or hollow corners, or side faces of flanges, of either wrought or cast iron or brass, may be polished with grain emery and oil, applied to the work on the end of a piece of soft wood, the operation being as follows: The end of the wood to which the oil and emery is to be applied should be slightly disintegrated by being bruised with a hammer; this will permit the oil and emery to enter into and be detained in the wood instead of passing away at the sides, as it otherwise would do, thus saving a large proportionate amount of material. The wood, being bruised, will also conform itself much more readily to the shape of curves, grooves, or corners. The hand rest is then placed a short distance from the work, and the piece of wood rests upon it, using it as a fulcrum. The end of the wood should bear upon the work below the horizontal level of the center of the latter, so that depressing the end of the wood held in the hand employs it as a lever, placing considerable pressure against the work; and the distance of the rest from the work allows the end of the piece of wood to have a reasonable range of lateral movement, without being moved upon the face of the lathe rest. The method of using the wood is the same as that employed in using emery cloth, except that it must, during the earlier stage of its application, be kept in very continuous lateral movement, or the grain emery will lodge in any small hollow specks which may exist in the metal, and hence cut small grooves in the work. Another exception is that the finishing must be performed with only such emery as may be embedded in the wood, and without the application of any oil; especially are these directions necessary for cast iron or brass work. The work may then be wiped dry, and an extra polish imparted to it by the application of fine or worn and glazed emery cloth, moved slowly over its surfaces.

Genius vs. Capital.

The great misfortune which causes the failure of many industrious, hard-working, correct people, in their efforts to benefit themselves and the world, is not so much their poverty, as many would have us believe, as their inability to interest others in their plans of business and progress. They frequently present schemes for the advancement of the arts and sciences, for the perfection of mechanical appliances, which have merit of an extraordinary commendable character, but which they are not able to bring into practical use because they do not find patrons to recognize the value of their ingenuity. So, frequently, it occurs that much is lost because it is not made available at the time of its inception. It is simply a miscarriage, in a physical sense. It is not owing to the poverty of the inventor. It may be owing to the lack of means; but we hold that a man is not poor when he has a sufficient supply of energy and brains to illustrate fairly any new principle in the mechanic arts. Brains are two-fold more valuable than money. But the poverty exists on the part of those who are not able to see and apply the devices for progress which come up under this head. We do not censure a man for not entering enthusiastically into a scheme which he does not understand, but we do censure men who, being favorably situated, cannot understand and assist a scheme which has merit and brains in its conception and application.

Thus one man may be rich in devices, and another in material wealth; but they do not come together because the man of wealth, not having the brains of the inventor or projector of a scheme for progress, and not willing to inform himself, stands aloof and says to the inventor: "You are a poor fool—why should you bother me?—I've no time to spend with you. If you have something so good as you represent it, why don't you prove it practically before the world, and not trouble us capitalists for means to assist you?"

Here is where the most wealthy man—the one who furnishes means for capital to double itself—becomes poor, and where he is humiliated, and depressed and discouraged, may be to the extent of distress, simply because he has not the "almighty dollar" to aid him.

There is too much of this subject to be preached in one sermon, says the *Trade Review*, which we quote.

A New Method of Preparing Plaster of Paris for Casts

Not a very long time since, some lucky individual struck upon the happy thought that plaster of Paris would be improved by mixing it with a solution of alum, and such in reality proved to be the case. This induced a Frenchman named Landrin to study the action of the alum in this case, and he arrived at the conclusion that its principal *rôle* was to convert any caustic lime, of which there is always more or less present, into a sulphate. Starting with this idea, he attempted to accomplish the same result by the use of other sulphates, and in this he succeeded. Next he tried the effect of using just enough dilute sulphuric acid to effect this conversion into sulphate, and afterwards calcining it. Finally, he ascertained that the quickest and simplest way was to immerse the unburnt gypsum for 15 minutes in water containing 8 or 10 per cent of sulphuric acid, and then calcine it. Prepared in this way, it set slowly, but made excellent casts, which were perfectly white, instead of the usual grayish tint. The latter effect is due to the destruction of a small amount of organic matter by the slight excess of sulphuric acid

J. A. D. says: "A clerical error occurs in your report of Mr. Wells' address on the distribution of wealth, in stating the average amount of property for each inhabitant in this country to be $6,000, based upon a grand total of $25,000,000,000. A glance shows an error of one cipher, and the $6,000 should be $600."

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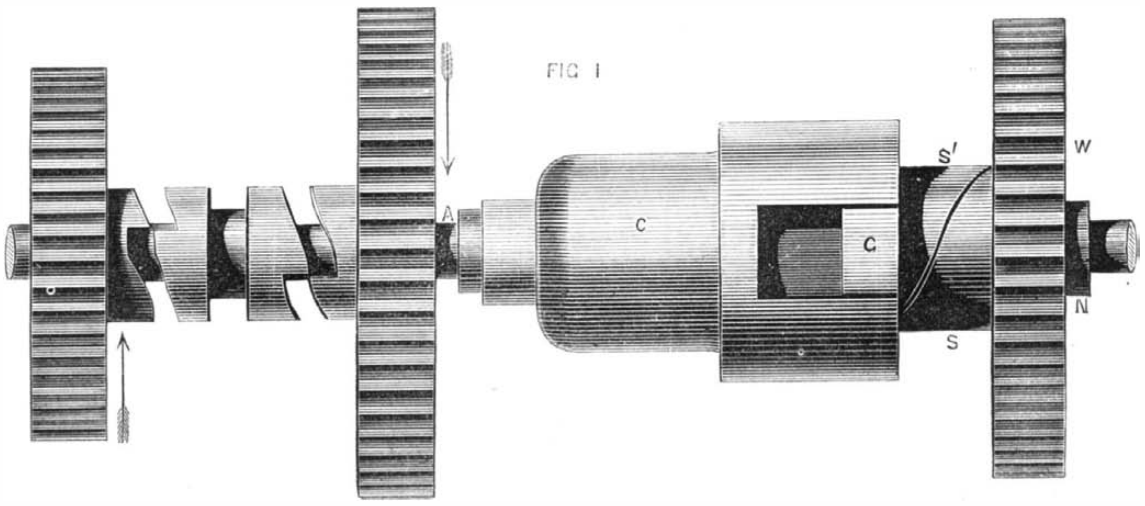
IMPROVED POWER COUPLINGS.

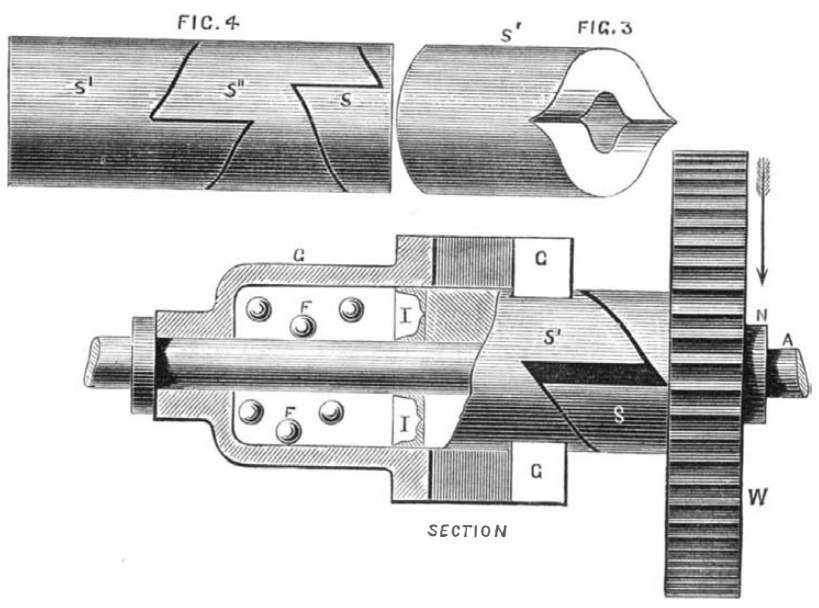
At the recent meeting of the Iron and Steel Institute of Great Britain, a paper on power couplings for rolling mills and other machinery, the joint production of Messrs. F. H. Varley and Edward Furness, was read; and its chief point was a description of a new means of controlling and reversing mills which receive their power from a continuously and uniformly driven shaft, where the fly wheel picks up the accumulated momentum. This is accomplished by the means shown in our engravings, in which Fig. 1 shows the ordinary reversing gear, the shaft having an hydraulic coupling, the interior of which is shown in Fig. 2. The wheel, W, and the screw-shaped boss, S, is loose on the shaft, A; and the boss acts against a screw-faced cam, S^1, at the end of the ram working in an hydraulic cylinder, C, the packing, I I, being between the ram, shaft, and cylinder. The ram has lugs, G G, which move in slots which allow the ram to glide into the cylinder, but prevent the rotation of the ram. India rubber balls, F F, are placed in the water of the cylinder. Upon motion being communicated to the shaft, A, in either direction of the arrows, by the clutch, it causes the cylinder, C, and the ram, S^1, to revolve together and drive the wheel, W, by the screw-shaped faces acting against one another like the horns of a common fork clutch. Now, should there arise any sudden strain on the wheel, W, the shaft, A, and the attachments to it will not receive the shock, but will continue to rotate, and the screw-shaped face, S^1, of the ram, acting on the similarly screw-shaped boss, S, of the wheel, will force the ram into the cylinder, C, and compress the elastic material placed in the water, which will spread the force of the blow over a period of time and destroy its intensity; and when an equilibrium of power is established, the ram, S^1, will resume its original position by the screws gliding back over one another in proportion as the strain is reduced. It is preferred to make the pitch of the screws wide, so that the elastic material may be able to better overcome the resistance.

The action of the coupling may be briefly described thus: The screw-shaped faces, S and S^1, act against one another as a common fork clutch, and when the shaft, A, is in motion it carries round with it the cylinder, ram, and wheel; if the wheel be retarded the shaft will continue to rotate, but in so doing forces the ram into the cylinder until the elastic material is compressed with a force equal to the resistance opposing the rotation of the wheel; when the obstacle is passed, the pressure in the cylinder will be in excess of the work then doing, this accumulated pressure will be given out again and bring the wheel, W, which drives the mill, quickly to its original speed, and this is effected as gradually as the shock of the stoppage had been previously relieved by the form of the screw faces, S and S^1, so that there is neither concussion nor sudden strain in stopping or reversing.

Figs. 3 and 4 show forms of right and left-handed screws combined, which can be used for forcing the ram into the cylinder, supposing the shaft to be driven in either direction.

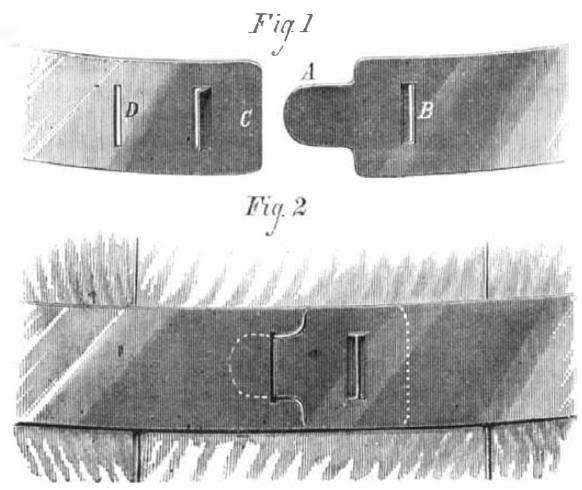


VARLEY AND FURNESS' POWER COUPLING.



IMPROVED BARREL HOOP.

We illustrate herewith a strong and cheap hoop for fastening on kegs, pails, tubs, and other similar packages. The device, which is both simple and ingenious, may be entirely made by machinery and placed in the cooper's hands complete in itself, no hammering being necessary to put it together for driving on the barrel. It requires no rivets; and hence the labor of making holes and of securing such fastenings is obviated, thus saving time and expense. Fig. 1 shows the manner in which the ends are formed, and Fig. 2 represents the extremities locked together. One end has a tongue, A, and a slot, B, the projecting piece caused by the cutting of said slot at three sides being bent to the rear. The opposite end has also a slot, C, similar to B, the piece being, however, turned to the front, and another opening, D, from the interior of which the metal is altogether removed. In locking the ends the tongue, A, enters the opening, D, as indicated by dotted lines in Fig. 2, and the projecting piece of slot, B, enters slot, C, and *vice versâ*. When the fastening is to be extra strong, for large packages, a series of two or more slots, like B C, can be made. This makes a firm, tight joint, with no ends exposed and liable to be turned back, the hoops being so broken in rolling the barrel.

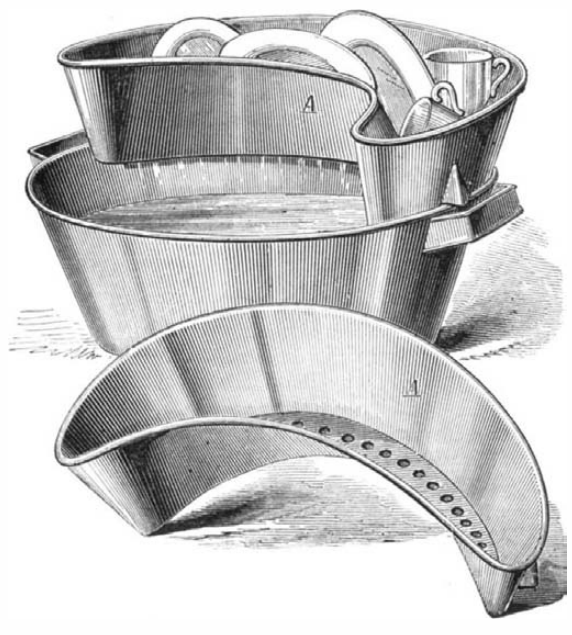


The device is claimed to be stronger than the hoop fastenings now in use, because it presents a greater surface to the strain. It may also be adapted to serve as a bale tie, and in many other cases where a fastening of the ends of bands is necessary. If desired, the hoop can be removed from the barrel and opened, when it is ready to be applied to another cask in as good condition as when first used.

Patented through the Scientific American Patent Agency, April 27, 1875. For further particulars address the inventor, Mr. Leopold Weil, 18 Market street, Chicago, Ill.

ABBE'S DISH AND VEGETABLE DRAINER.

Dishes, when laid aside to drain in a pan or sink, frequently slide one upon the other, and become chipped and cracked; while occasionally, even when carefully piled, an accidental blow may result in the overthrow of the heap and consequent wholesale breakages or injury to the china. The invention herewith illustrated is an attachment to the ordinary dish pan, into which the dishes are placed to drain as washed, the water dripping from them through the bottom of the receptacle and into the pan below.



The device consists of a crescent-shaped pan, A, which is supplied with suitable lugs by which it is attached on the edge of the dish pan, the bottom of which is perforated. As shown in the engraving, the articles are placed in this pan, where they drain quickly and thoroughly. The attachment may also be used as a colander for draining the water from vegetables. Three sizes of the invention are now constructed.

Patented December 15, 1874. For further information address the patentee, Mr. J. R. Abbe, Providence, R. I.

The Eagle Wing Propeller.

We recently witnessed a trial of Judge Patterson's new screw propeller the Eagle Wing, to which reference has lately been made in a letter of Mr. R. H. Buel, published in our advertising columns. The screw (of 12 feet diameter) was placed in the New York *Herald* steam yacht which vessel steamed about the harbor for some hours, in order that her speed might be tested over measured distances. The best time made was a distance of two and a half miles in ten minutes. The propeller worked with remarkable smoothness, the after part of the boat being almost entirely free from the vibration ordinarily noticeable under like circumstances.

FULLER'S COMBINATION PACKING.

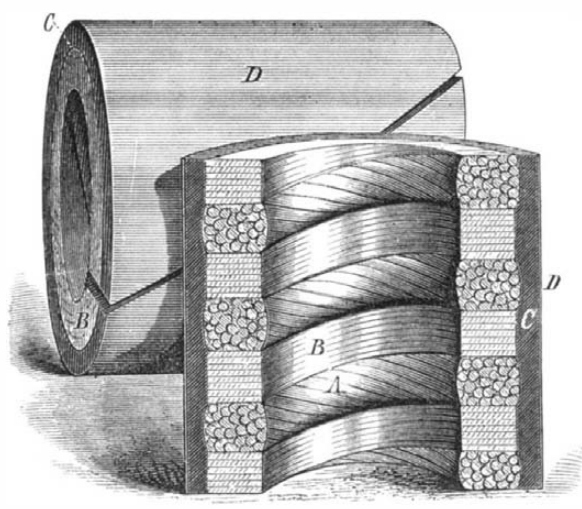
A new packing is represented in the annexed engraving, by the use of which fluted rods are prevented, and which may be employed on all kinds of steam engines, pumps, presses, etc. It is claimed to produce less friction on the rod or stem, and to be of much greater efficiency than any other packing now in the market.

It is composed of a coil of hemp rope, A, and a coil of rope, B, made of rubber cloth. The hemp is well filled with pulverized soapstone. Both ropes are wound around a mandrel of the size of the rod or shaft to be inclosed, and then surrounded by a casing, which consists of a rubber tube, C, enveloped in canvas or other flexible material, D. The piece is then cut off square so as to fill the stuffing box. The packing may be set in place by cutting it open longitudinally, either in parallel direction to its axis, or obliquely, as shown in the illustration.

The device is elastic, and is made to hug the shaft or rod by screwing down the gland. The rubber casing keeps the coils in place, and the soapstone combined with the hemp prevents friction. The inventor informs us that one set of packing has been used in freight and passenger locomotives for from four to six months, and in stationary engines for from eight to twelve months, requiring tightening but once a month.

The invention is simple and appears to be durable, while its friction-reducing qualities will probably render it, in large measure, a preventive of wear upon the moving mechanism.

Patented through the Scientific American Patent Agency, January 13, 1874. For further particulars address the inventor, Mr. C. H. Fuller, Akron, Ohio.



Twenty-four Hours at Sea in a Life Preserver.

Captain Boyton, whose daring exploits as an exhibitor of the new life-preserving dress we have heretofore mentioned, lately accomplished a greater feat than ever before, namely, the crossing of the English Channel. He started from Boulogne in France at 2.30 A. M., and paddled himself across the sea, 25 miles, to Folkestone, England, in 24 hours.

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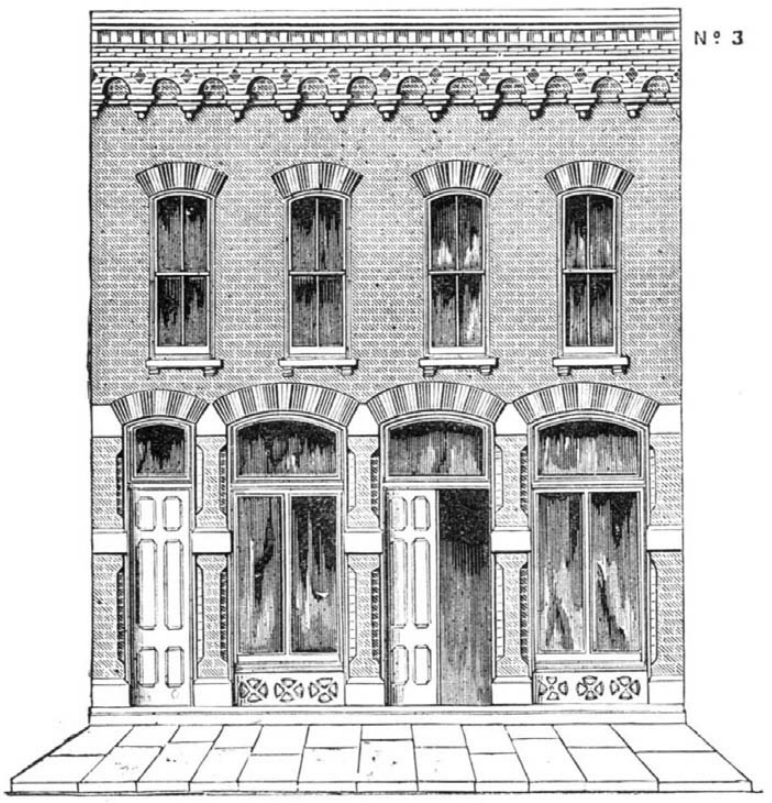
THE HOMES OF THE WORKING CLASSES.

There is little doubt that, in many of our large cities, building houses for the wealthy has been overdone; and it would be fortunate for New York if the capital invested in hundreds of blocks of many-storied mansions, fit only for men of large fortune, could be recovered and devoted to the erection of dwellings for persons of moderate means. It is better to build houses worth $600 or $700 a year, and readily find tenants or purchasers, than to have a square mile of empty palaces on hand, and to mortgage them to pay the taxes. The city of Philadelphia is noticeable for the large number of convenient houses of moderate pretensions which are to be found in all its wards; and the mutual help principle has done much to encourage the development of such investments, the Quaker City having 500 or more building societies and loan associations. In 1874 there were built in Philadelphia 4,439 houses, under the auspices of the loan associations; and during the past four years 19,120 were put up—11,162 being two-story or less, 7,831 three-story, and 127 four-story. Boston, with half the population, erected in the last few years more than one fifth fewer than Philadelphia. But the separate home system, as exhibited in the buildings of the Quaker City, is being extensively copied.



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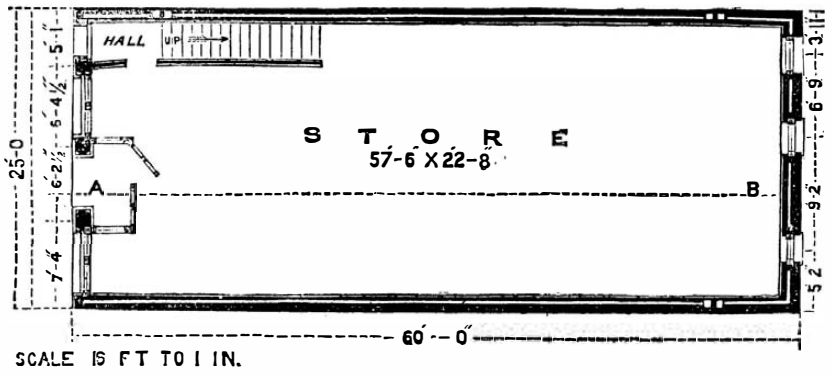

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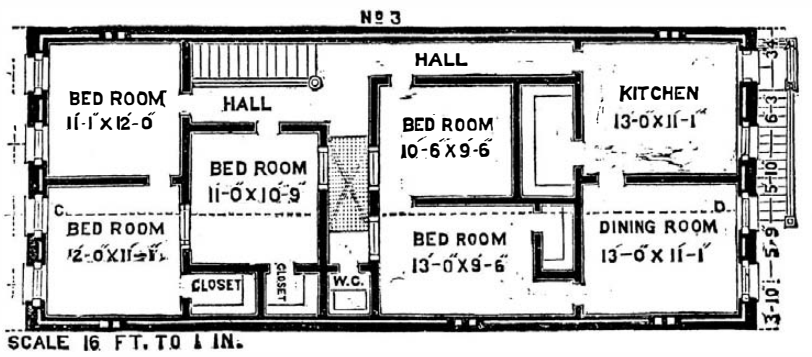
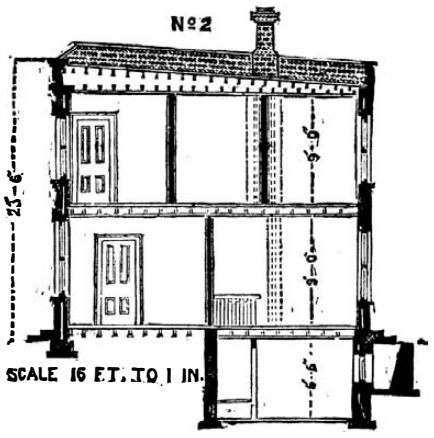
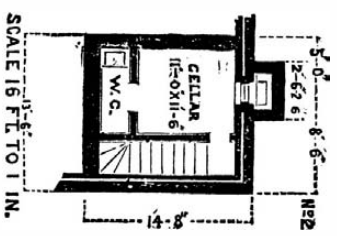
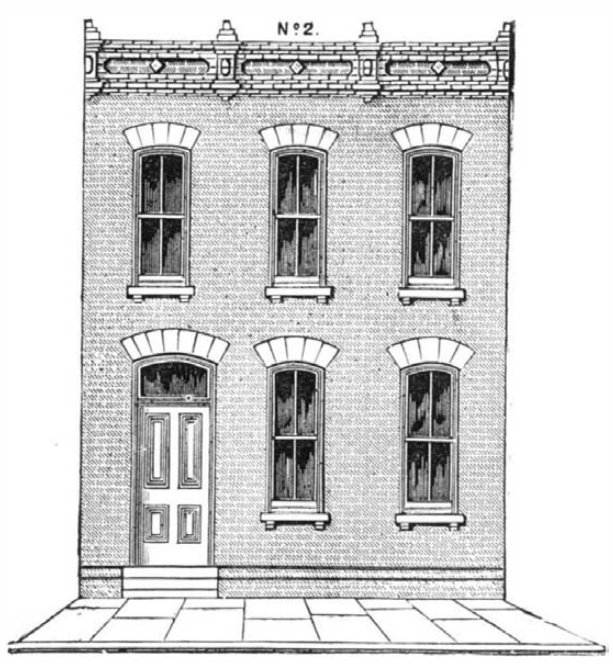


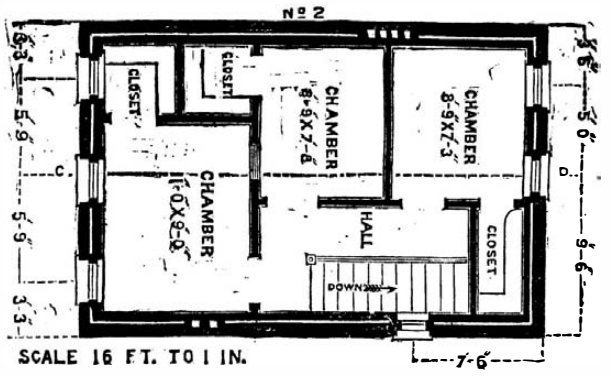
PRIZE PLANS OF A TWO-STORY DOUBLE FIREPROOF HOUSE, WITH STORES, TO COST $3,600.

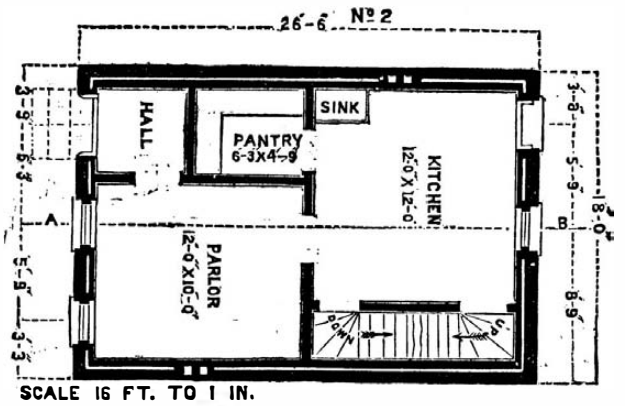


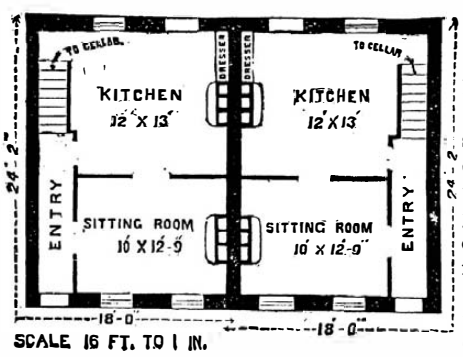


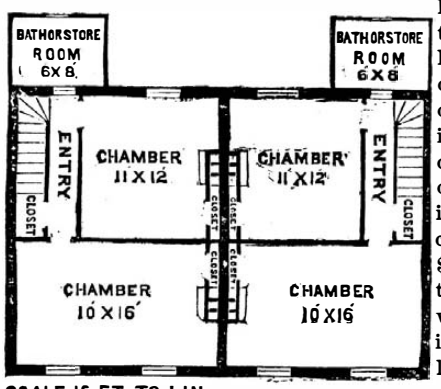


PLAN OF A TWO-STORY BRICK FIREPROOF HOUSE TO COST $1,700.





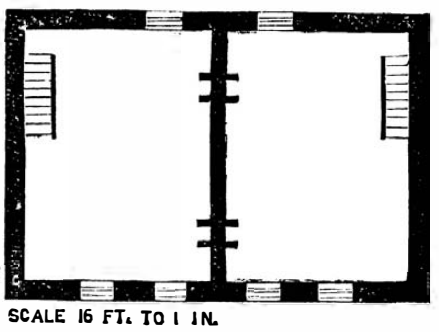




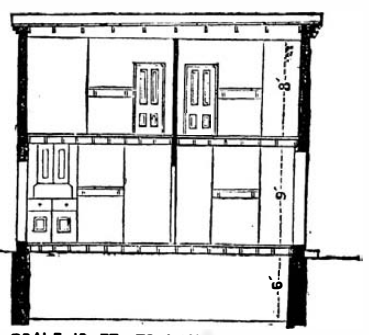
It will be well when every large city is fringed with such residences. During the last ten years the Merchants', Farmers', and Mechanics' Savings Bank of Chicago has had from a quarter to half a million of dollars constantly loaned out on mortgage in the city of Chicago. At the time of the great fire its loans in the cityamounted to $240,000. Forty buildings, on which, with lots, it had made loans, were destroyed, but as the lots without the buildings were worth more than the amount loaned on each independent of the buildings, the bank did not lose a dollar. The loans were mostly to depositors in the bank, and the buildings were mostly cottages. After the second fire, a city ordinance was passed, prohibiting the erection of wooden buildings within the limits of the city. Many depositors in the bank found themselves possessed of lots which, by reason of the increased cost of building brick outer walls, they were unable to utilize. The

NEW STYLE PHILADELPHIA FIREPROOF HOUSE.

usual proportion of money loaned by the bank on lots was not sufficient to erect buildings of a construction permitted by the fire laws. Yet mere brick walls, without secure roofs, floors, ceilings, etc., were believed to be but little better as security for money loaned than the same buildings with wooden exterior walls. For the purpose of ascertaining how cheaply, approximately, fireproof buildings adapted to various classes could be obtained, the Merchants', Farmers', and Mechanics' Savings Bank, on the 15th of October, 1874, published a circular offering a prize of $1,000 for the best set of plans and specifications for a dwelling of not less than five rooms, and a capacity of not less than 5,500 cubic feet, and of a store and dwelling combined, for use on such thoroughfares as Archer and Milwaukee avenues, to contain not less than 30,000 cubic feet of space, with price and proposals to build one or fifty of either or both buildings. More than thirty sets of plans and communications were received previcus to January 1, 1875. A committee examined these plans and made an award of the prize to A. J. Smith, architect and contractor, of 338 West Randolph street, Chicago, for plans of a one-story house, 20x43, cost $1,200;, a two-story house, 18x26, cost $1,700; and a two-story store and dwelling, 22x57, cost $3,600. We have already described and illustrated some portions of Mr. Smith's system, but the importance of the matter induces us to give here complete details and illustrations.



The one story dwelling house is a brick building, 42x20, of five rooms, consisting of parlor, 13x12, dining room, 13 feet 5 inches x 16 feet 6 inches, kitchen, 10x10 feet 6 inches, and two bedrooms, 10x6 feet 6 inches each. The hight of each room will be 10 feet in the clear between floor and ceiling. An important feature in this plan is that,



MODEL FIREPROOF DWELLINGS FOR WORKING MEN

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should a fire occur in the front room of the building, the rear portion may be preserved intact, and *vice versâ*. The outside walls are hollow from foundation to roof. The floor, beams, and rafters are wood, protected from fire by concrete one and one half inches on the ceilings and underneath the floors, and the roof is covered with tin on the top of the concrete. Thorough ventilation is provided by flues adjoining the fire flues, and topped out in the chimney. There is an air space ventilated underneath the ground floor, preventing dampness from arising; and there is also an air space ventilated between the ceilings and roof, to prevent the heat of summer from affecting the rooms. The fire flues will be lined with burnt clay pipes, eight inches square, to prevent fires from defective flues. There will be a drain pipe, connected with sinks and closets, and with main sewer, to carry off all surface water, slops, etc.

The two-story dwelling is a building 26 feet 6 inches x 18 feet, with five rooms, two on the ground or principal floor, and three on the upper floor, the sizes of which are: Parlor, 12 x 10; kitchen, 12 x 12. The three upper rooms are for bedrooms, the sizes of which are, respectively, 11 x 9, 8 feet 9 inches x 7 feet 9 inches, and 8 feet 9 inches x 7 feet 9 inches.

This building has a cellar for coal and wood, and fitted up with water closet. The size of cellar within walls will be 12 x12. The upper story will be 9 feet in hight, and the principal story 10 feet; the cellar 6 feet 6 inches.

The building with store and dwelling combined is 25x59. The entire principal story is occupied with store room. The upper story is divided into seven rooms, consisting of two parlors, 11x12 each, bedroom, 11 feet x10 feet 6 inches, bedroom, 13 feet x 9 feet 6 inches, bedroom, 10 feet 6 inches x 9 feet 6 inches, kitchen, 13 feet x 11 feet 1 inch, dining room, 13 feet x 11 feet 1 inch.

Four model brick buildings are now being erected on Sacramento street, and will be known as Sacramento terrace, besides seventeen others in very desirable sections of the city. The exterior walls are hollow, one being eight inches thick, the other four, with a space of three inches between. The shells are tied together with wrought iron bolts. All rafters and floor beams are protected from above and below by artificial stone plastering one and a half inches thick, and no wooden lathing or furring is allowed. Each house is furnished with a bath room, and also a white stone front stoop, stone sills, and terra cotta caps. The façades are painted, and the brick cornices and water pipes are brought into relief by having a darker coating. The purchaser is required to pay down a given sum at the time of purchasing, and can then give a mortgage for one half the entire amount, and pay the remainder in monthly instalments. Over fifty acres of ground have been bought near the West Side Parks, upon which houses of these general plans will be erected.

One of the most striking features of these buildings is the fireproof plastering, which is applied as follows: A twelve-penny nail is driven into bottom of joist, less say three fourths of an inch, every three or four inches; an endless strand of strong wire is then wound once around the head of a nail, and passes from one to the other. A movable platform is then built, the top surface of which is one and a quarter inches from lower line of ceiling joist. This concrete material is then put in from top of joist on to platform, say from one and a half to two inches in thickness. As soon as the plaster sets, the platform is lowered, moved along, and readjusted, etc. A man weighing two hundred pounds has walked and stamped on this plastering in thirty minutes after it has been put on. By a little different method of applying the wire, and arranging the strands half an inch apart, it can be plastered in the ordinary way from the under side.

The composition, when put in from the top, is as follows: About one half cinders, crushed furnace slag, or brick bats; one fourth ordinary good plastering hair mortar; and one fourth coarse, strong plaster of Paris. It will be observed there is no plastering from the underside, except putting on the hard finish—the platform forming the surface to receive the hard finish.

This is considered, to all intents and purposes, a fireproof plastering, and would, in all ordinary cases, prevent fire from communicating with the joist.

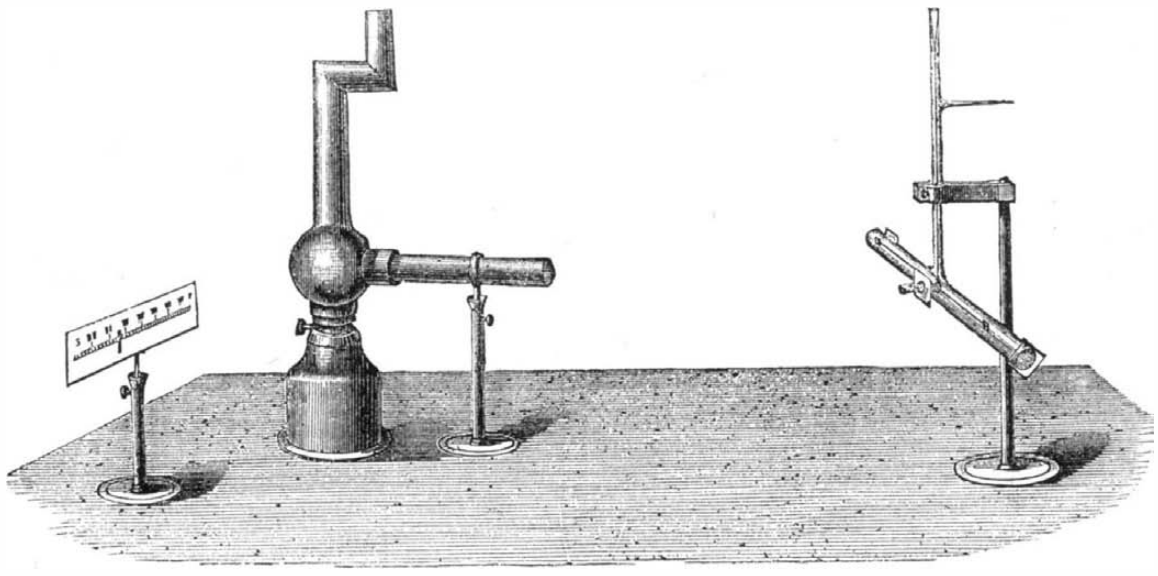
Lining Boilers with Copper.

M. F. Pupka, a Viennese engineer, gives the following facts regarding experiments in lining steam boilers with sheets of copper in order to hinder incrustation: Of the three plates which formed the bottom of a locomotive boiler, the two at the ends were covered with a sheet of copper 0·04 inch in thickness, the middle one being left bare. The machine was used steadily for two years and in districts where the water is of excessively bad quality. On removing the tubes recently a layer of incrustation 4 inches thick was found on the iron surface, while a deposit varying from only 0.08 to 0.12 inch thick appeared on the copper. The iron also was corroded in many places to a depth of 0·02 inch, but the copper had remained perfectly clean and bright. The texture of the incrustations showed larger grains on the iron than on the copper.

THE RADIOMETER.

We have already mentioned the important invention, by Professor Crookes, of a motor actuated by solar light radiation, exhibited at a recent *soirée* of the Royal Society, London. We give herewith illustrations of this wonderfully sensitive machine.

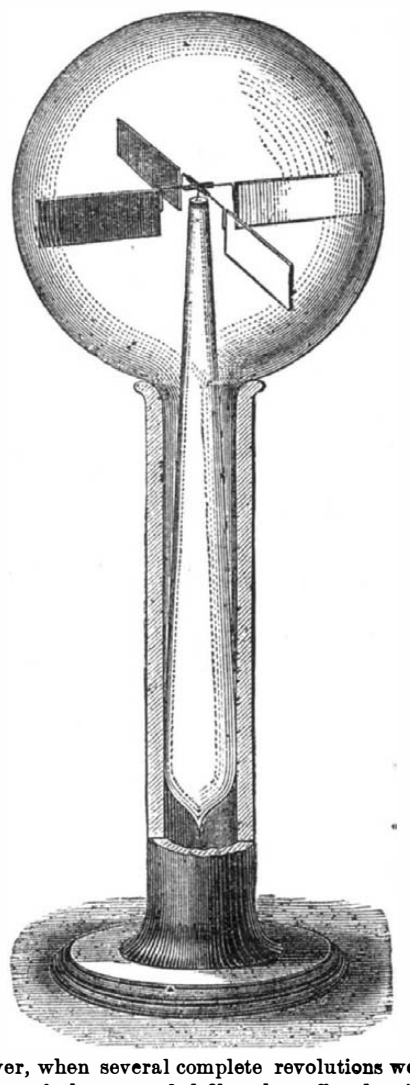
Mr. Crookes began by stating that, in the paper which he had previously read to the society, he had made known how a lever arm of pith, delicately suspended in a very perfect vacuum, was repelled by the impact of light or radiant heat. A great condition of success in the experiments was to work with the highest possible rarefication; consequently the lever arms were suspended in glass bulbs from which the air had been exhausted by means of the Sprengel pump, which gives a far more perfect vacuum than can be obtained by the use of any other apparatus. Until these experiments were made it was supposed that light had no action upon a lever arm of small ponderosity suspended in vacuo. Indeed, the circumstance that light could not turn a lever arm so suspended has been quoted in standard scientific text books, by Dr. Balfour Stewart and others, as one point in the long chain of evidence against the truth of Newton's emission theory of light.



PROFESSOR CROOKES' RADIOMETER.—Fig. 1.

Mr. Crookes has since exhibited a bar of pith suspended by a cocoon fiber in a large glass bulb very well exhausted. When a lighted candle was placed about 2 inches from this bulb, the pith bar began to swing to and fro, the swing gradually increasing in amplitude until the dead center was passed over, when several complete revolutions were made. The torsion of the suspended fiber then offered resistance to the revolutions, after which the bar began to turn in the opposite direction, and so on alternately. These movements were kept up with energy and regularity so long as the candle continued to burn. When instead of a candle a piece of ice was placed near the bulb, one end of the lever arm came toward it as if attracted; but the truth was, as explained by Mr. Crookes, that radiant heat was acting upon the pith bar from all parts of the room, and that the presentation of the piece of ice lowered the radiation on one side; consequently the movement was really caused by repulsion from the opposite direction.

Fig. 2.



In order to measure some of these effects, Mr. Crookes uses a piece of tubular glass apparatus in the shape of an inverted T, Fig. 1, containing a horizontal glass beam, suspended by a very fine glass thread. At the extremities of the beam were attached the substances to be subjected to experiment. In the center of the beam was a small mirror, from which a ray of light was reflected on to a graduated scale, just as in Sir William Thomson's reflecting galvanometer. Thus the amount of repulsion produced could be measured. The advantage which a glass thread possesses over a cocoon fiber is that the index always goes back to zero. The fiber used to suspend the arms are so excessively fine that, when the end of one of them is held in the hand, the fiber usually curves upwards like a cobweb until the other end of it floats almost vertically in the air.

As the vacuum becomes less perfect, the repulsion grows less, until at last the neutral point is reached, where there is no action at all. If still more air be then admitted, attraction instead of repulsion sets in. The barometric pressure of the neutral point varies with the density of the suspended substance on which the radiation falls; it varies also with the ratio of its mass to its surface, and with several other conditions. Thus the neutral point for a thin surface of pith being low, while that for a moderately thick piece of platinum is high, it follows that, with a rarefication intermediate between these two points, pith will be repelled while platinum will be attracted by the same power of radiation. Mr. Crookes proved this experimentally, by showing simultaneous attraction and repulsion by the same ray of light.

When these experiments were first made known, some of the observers tried to account for the effects by the assumed action of feeble air currents or of electricity, but both these hypotheses were considered by Mr. Crookes to be abundantly disproved. Professor Osborne Reynolds suggested that the movement might be due to evaporation and condensation at the surface of the suspended body. Mr. Crookes had a thick and strong bulb blown at the end of a piece of difficultly fusible green glass, specially made for boiler gages. In it he supported a thin bar of aluminum at the end of a long platinum wire, the upper end of which wire was passed through the top of the tube and well sealed, for electrical purposes. The apparatus was sealed by fusion to the Sprengel pump, and the exhaustion was kept going on for two days, until an induction spark refused to pass across the vacuum. During this time the bulb and its contents were several times raised to a dull red heat. At the end of the two days' exhaustion, the aluminum bar was found to behave in the same manner as, but in a stronger degree than, it would in a less perfectly exhausted apparatus, namely, it was repelled by heat of low intensity and attracted by cold.

The most remarkable of all the facts made known by Mr. Crookes was an apparent difference between the action of radiant light and radiant heat. At the highest exhaustions, dark heat appeared to act almost equally on white pith and on pith coated with lampblack, repelling either with about the same force; but strange to say, the luminous rays repelled the black surface with more energy than the white one. This is all the more remarkable because, light being reflected from a white surface, it might have been supposed that the consequent rebound would have repelled the white surface more than the black one.

The apparatus is shown in Fig. 2, and consists of four arms suspended on a steel point resting on a cap, so that the arms are able to revolve horizontally upon their central pivot, just the same, in fact, as the arms of an anemometer revolve. To the extremity of each arm of straw, in the apparatus made by Mr. Crookes, is fastened a disk of pith, white on one side and black on the other, the black surfaces of all the disks facing the same way; the pith disks are each about the size of a sixpence. The whole arrangement is inclosed in a glass globe, which is then exhausted to the highest attainable point and hermetically sealed.

This arrangement rotates with more or less velocity under the action of light. With one of the instruments, the arms revolved once in 182 seconds when a candle flame was placed at a distance of 20 inches. When the same candle was placed at a distance of 10 inches, one revolution in 45 seconds was the result; and at 5 inches, one revolution was given in 11 seconds. Thus it will be seen that the mechanical effect varies almost exactly inversely with the square of the distance, so that the theory and the experiment coincide as to their results.

In these experiments Mr. Crookes had to be very careful to guard against the effects of undesired radiation. The lighted sun burners of the roof of the hall of the Royal Society interfered with some of the results, and a candle placed incautiously near his bulbs would send the contents of some

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of them spinning. As the velocity with which they spin varies with the intensity of the light, in these instruments we have a new form of actinometer. At present there is no good and scientifically exact method of making actinometrical measurements; but these discoveries may possibly result in the production of a more perfect instrument for this purpose.—*The Engineer.*

HOUSEHOLD HINTS.---II.

We have often wondered by what powers of designing the makers of moderate priced furniture contrive to make chairs and sofas, as a rule, in such outrageously uncomfortable shapes. Why, indeed, should chairs be constructed with seats inclining forward, or with backs hollowed in below and protruding above, so as to furnish support to but two points, and these exactly beneath the shoulder blades? It is a positive labor to sit in such chairs, and no amount of disguise, in the shape of fancy covering or upholstery, should ever beguile a person into purchasing one. The proper shape for a chair is a broad, moderately low seat inclined rearward, and the back should be just the reverse of the form above described—in other words it should conform to the natural curvature of the spine. The frame becomes a support and comfortable rest for the body, while otherwise its tendency is to push the shoulders forward while the lower part of the person slides in the same direction on the seat, the result is that the occupant must either sit back in a round-shouldered position, or else balance himself on the very edge of the seat; in both cases finding himself the reverse of comfortable. The same remarks apply to sofas, and especially to those made with straight backs and in the pretty gothic forms which are now so fashionable. Buying furniture for comfort and buying it for looks are very different matters—in fact, there is a distinct class of furniture which is gorgeous to the eye but simple martyrdom to the body. It includes pine or whitewood chairs, covered with plaster of Paris, gilding, and satin, which are meant to be admired but not to sit in; and an endless variety of brass-mounted tables, footstools, cabinets, and like objects the cost of which appears to augment in exactly invese ratio to their utility. With such, we have nothing to do here. We propose simply to talk about articles that can be used, and used comfortably.

For stuffing furniture, there is nothing equal to good white curled horse hair. It will last indefinitely, for it is susceptible to almost perpetual regeneration. There is no economy whatever in paying twenty or thirty dollars less for a set which is filled with tow, moss, excelsior, or any other of the numerous materials used as substitutes. To be sure, the articles look exactly as well in the beginning as if stuffed with hair; but a year's wear, evidenced by the sunken seats and cushions, will speedily show the difference. It is better to select furniture before it is covered, as then a small hole, surreptitiously, if need be, poked in the side of a seat or back, will soon prove whether the salesman's too frequent protestations that "we use only the best hair" are founded upon fancy or on fact.

While horse hair is most suitable for the inside, we have very little liking for the same material made into cloth as a covering for the exterior, although it is the most enduring of all materials. Hair cloth is black; and as the articles upon which it is used are the principal objects in the room, the general effect to our minds is funereal and depressing. The heavy deep shade cannot, when in such masses, be acceptably toned down by contrasts, nor can it be enlivened so that the general appearance of the room is rendered bright and cheerful.

Good stout woolen reps are among the best fabrics to wear. Silk rep is just the reverse, while not one person out of ten can tell the difference in the fabrics across a room. Plush is also very strong and lasting, though it is not suitable for a modestly furnished room. Satine, though not equal to rep in wearing qualities, showing spots and dirt much easier, is by some considered handsome, and probably is better suited than the latter for a parlor.

In regard to color, the hues of the carpet, unless Turkish rugs are used, and that of the wall paper are again to be taken into consideration. With a gray toned wall and carpet, crimson is the proper shade for the furniture. Blue looks nicely with a rich dark carpet having no green in it, or with a blue carpet of a harmonizing shade. Crimson or green furniture accords well with either brown or green carpeting. Brown upholstery requires a green carpet. Covering furniture with two distinct colors or shades is now quite common, and is preferred by many to a single shade or color throughout. The body of the piece is upholstered in gray rep, for example, and the edges surrounded with blue puffings. There is a variety of pretty combinations of colors, of which in such a case advantage may be taken. Deep blue and golden brown, chocolate and bright blue, gray and pink, maroon and warm green, claret and buff, are instances in which the tints make pleasing contrasts.

Wood work enriched with gilding is now extensively made, and even enters into the construction of the cheapest grades of furniture. We do not counsel its purchase, as the gilding, especially in cheap goods, wears off very easily, leaving the articles badly defaced. A few pieces of furniture about the room differing from the principal set will be found to give a pleasant and furnished look to the apartment. A very neat chair, made by the Shakers and at some of the penitentiaries, is now sold at from five to ten dollars. It has a light though stout wooden frame, of simple pattern; and the seat and back are made of plaited webbing of two colors, either red and blue, or green with gray or black. One red chair of this kind makes an attractive spot of color to a room furnished in green. Then there are the so-called oriental chairs, something after the camp stool pattern and having high backs. These may be purchased as low as ten dollars apiece, and may well take the place of the much more expensive stuffed easy chairs.

We prefer a wooden top covered with a handsome cloth, to a marble slab, for a table. There is something cold and uncozy about marble; it makes us think of a burial tablet, such as one sees in country churches.

About the cloth we shall have something to say in another paper; but just here we desire to remark that a number of small tables, on which one can place ornaments without fear of obscuring either inlaid work or fancy marble, can be arranged about a room so as to be much more ornamental than one large table deposited in the center. Stands of very pretty and graceful shape can be obtained, made of bamboo. These are quite cheap, and their light yellow color contrasts nicely with the darker wood of the heavier furniture. We have seen very tasteful home-made tables of cane, dried and varnished; also of white wood, ornamented with bracket saw carvings. Holly wood, if attainable, when smoothed can be painted upon in water colors and afterwards varnished; or the material may be even pine painted black, and have fall leaves arranged upon it in pretty designs, and then covered with two or three coats of copal varnish.

In arranging furniture about a room, bear in mind that it is not necessary to push every article primly out to the sides, so that sofas and chairs look as if they were glued to the wall. Pull them out; put a sofa across one corner; stand the big easy chair in the light, with a little table close by, handy for sewing or books; leave a chair or two in front of the sofa; and in general so dispose the articles that the room shall not appear as if its owners never entered it save on ceremonial occasions. Whether a room is pleasing and cosy or not does not depend upon the elegance or costliness of its fittings. The simplest furniture, if tastefully arranged as regards color and position, often looks better than the handsomest products of the cabinet maker's skill. In our next paper, we shall discuss a few simple styles of curtains and decorations.

Miniature Steam Engines for Light Work.

We have frequently stated our belief that there is a growing want in the community for small steam engines, machines of one horse power and under, which might advantageously serve as a source of power in a variety of uses. As no greater skill would be required in the generation of such power than in the boiling of a teakettle, it would seem that a simple steam engine, driven by a boiler thoroughly protected against explosion, might find employment both as a domestic motor and for light work in the shop. It could turn wringers, churns, washing machines, or ice cream freezers, run coffee mills, pump water through a house, actuate foot lathes, scroll saws, or light box-making machinery, run knitting or sewing machines, turn a grindstone or emery wheel, work ventilating fans, hand thrashing machines, cutters, meat or feed choppers, or sausage machines, drive small blowers for pneumatic dispatch tubes in a building, or for a blacksmith's forge, or compress air or work an air pump on a small scale in the laboratory. These are but a few of the applications which suggest themselves as we write, and the reader will doubtless be able to recall many more.

The principal obstacle to the employment of the steam engine hitherto, for such uses as above detailed, has been its cost. No manufacturer, so far as we are aware, has ere this prepared the necessary patterns and mechanism for producing small engines on a large scale, so as to allow of their sale at low rates, so that there has been no way of obtaining the machines save by employing workmen especially to build the same, a course involving considerable expense.

A couple of small engines have, however, recently been forwarded to us for examination, which, if we may take them as specimens of the general product of their manufacturer, abundantly prove that he has read our oft repeated assurance that such motors were in demand, and is taking proper steps to meet it.

The two engines submitted to us are certainly admirable pieces of mechanism. One would probably develop half a horse power, perhaps more, and the other, which is running at full speed on our desk as we write, is intended as a toy. The larger machine has a copper boiler, 10 inches in diameter by 18 inches high, with furnace and all necessary gages and fittings. The cylinder of the horizontal slide valve engine is 1⅜ by 2½ inches, and the fly wheel 12 inches in diameter. The small engine is of similar type and is furnished as perfectly and in as workmanlike a manner as if made entirely by hand.

The miniature sizes of engines are of course designed more as playthings for the boys; but the maker, Mr. George Parr of Buffalo, N. Y., has devised an ingenious way of rendering them at the same time a really valuable source of knowledge. To this end, besides finished machines, he prepares rough castings which he furnishes at reduced prices. These portions require no expensive nor elaborate tools to finish them. Any youth with a little mechanical skill can easily trim them, and then, putting them together, build his engine for himself. This we think an excellent plan, and one which cannot but result in the young machinist gaining ideas certain to be of much practical use to him in the future.

Mr. Parr's advertisement may be found in another column.

DECISIONS OF THE COURTS.

United States Circuit Court---District of Massachusetts.

PATENT TREMOLO.—GEORGE G. SAXE *et al. vs.* A. H. HAMMOND *et al.*

[In equity.—Before SHEPLEY, J.—January, 1875.—

SHEPLEY, J.:

This bill in equity alleges that the respondents infringe certain letters patent reissued to the complainants, as assignees of R. W. Carpenter, on the 5th of October, 1869, No. 3,665, for a "tremolo" attachment to musical instruments. The defendants deny infringement, and allege prior knowledge and use of the patented invention by La Fayette Louis and others more than two years before the date of the application of R. W. Carpenter; and also, that the same invention and discovery, and the same device described in said patent, and substantial and material parts thereof, were patented on the 18th day of November, 1856, to La Fayette Louis.

If the defendants could be held as infringers of the Carpenter patent, if it be a valid patent, and not anticipated by the devices which were made and used by La Fayette Louis at Chicago and other places, it would be necessary carefully to consider and decide upon the probative force and effect of the testimony in relation to those devices of Louis, which, if the testimony of the witnesses in relation to them is to be received with full credit, acted substantially as agitators to, or reflectors f, the waves or currents of air passing through the reeds of the musical instrument, and not as valves to interrupt the continuity of the musical notes. If they are operated in the way first described, they would seem to have operated in the same manner and with the like result as Carpenter's fan-tremolo, although Louis appears to have been ignorant of the philosophy of the operation—a want of knowledge which is imputable as well to Carpenter, and even to those who have the benefit of the theories (which are only claimed to be theories) of the most learned scientists who have testified as experts on this subject.

If, however, the evidence in this record is not sufficient to charge the respondents as infringers of the complainants' patent, it is not necessary to decide that question in this case.

The respondents are manufacturers of supplies of materials which are elemental parts of organs and other musical instruments. They sell to the organ manufacturers. It is not claimed that they have made any musical instruments or sold any in which the tremolo attachments of any kind are arranged, or to which they are applied in any manner. The complainants allege that they (the complainants) have licensed large numbers of manufacturers to put these fans in their organs, and proved that they agreed to license every reputable manufacturer who should apply. There is no evidence in this record of a sale to an unlicensed manufacturer of organs. The thing made by the defendants is shown by the exhibit produced in the case; a wooden structure of the simplest kind, which is in itself no infringement, and which, in order to constitute an infringement of the complainants' patent, must be placed by an unlicensed manufacturer in a musical instrument, and placed in a certain position in that instrument, external to the wind chest. A revolving fan is not new. All the respondents make is a fan capable of being made to revolve.

The complainants claim as their invention the application of any means to the musical instrument whereby the air may be agitated to produce a tremulous note "by agency *external to the wind chest*, which shall not check the flow of the air past the reeds," so as to give a continuous tremulous note, but not cut off the sound and make a succession of notes, instead of a continuation of one note. Whether the fan made by the respondents would infringe this claim when placed in the instrument depends upon the position and arrangement of it in the organ, whether or not it be placed external to the wind chest, whether it be placed so as to cut off the sound and produce a succession of notes, or merely to agitate the air and vary the musical notes without interrupting their continuity. Even if all these alternative conditions were on the side of infringement, there must be the additional element of a sale for use by an unlicensed manufacturer, which is not proved in this case.

The complainants rely upon the case of Wallace *vs.* Holmes, (3 Blatchford C. C. R., 65.) There can be no doubt of the soundness of the conclusions of the court in that case, or the cogency of the reasons given by the learned judge (Woodruff) in his opinion. But, without rehearsing the facts in that case, it is sufficient to say that they were very different from the case now before the court; the gist of the decision in that case was that the actual concert of the makers of the different elements in the combination was a certain inference from the fact in that case, and the distinct efforts of the defendants to bring into use those elements of the combination which comprised the whole invention, although they could not be used without adding one other element, were found to be proved. No such state of facts is proved in this case, as has already been shown.

I must, therefore, repeat what I stated to counsel at the argument of the cause. As defendants only make one element of the patented invention, in order to hold them guilty I must find proof connecting them with the infringement. Different parties may all infringe by respectively making or selling, each of them, one of the elements of a patented combination, provided those separate elements are made for the purpose and with the intent of their being combined by a party having no right to combine them. But the mere manufacture of a separate element of a patented combination, unless such manufacture be proved to have been conducted for the purpose and with the intent of aiding infringement, is not, in and of itself, infringement. A patent is valid for a new combination of old elements. A person who uses one or more of the old elements is not an infringer, unless he uses the new combination. (Prouty *vs.* Ruggles, 16 Peters, 336, 341; Byam *vs.* Farr, 1 Curtis, C. C. R., 260, 265; Foster *vs.* Moore, ib. 279, 288; Eames *vs.* Godfrey, 1 Wall., 78, 79.) The use of a part less than the whole is no infringement.

I infer from the remarks of counsel at the argument that, although respondents deny infringement, and do not waive this defense, it is desired that the court should pass upon the question of the validity of the interfering patents for the respective inventions of Louis and Carpenter. If the court should find the complainants' patent to be valid, no decree could be made in their favor, as respondents do not infringe. To find the complainants' patent invalid in a case in which the defendants do not infringe, would partake too much of the nature of a moot case.

Complainants' bill dismissed.

[*Whitney* and *Betts*, for complainants.
B. E. Valentine and *W. W. Blackmar*, for defendants.]

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From April 14 to May 15, 1875, inclusive.

ASTRONOMICAL APPARATUS.—H. Allen, New York city.
BLAST FURNACE.—W. A. Stephens, Succasuna Plain, N. J., *et al.*
BLIND REGULATOR, ETC.—J. T. O'Donoghue, New York city.
BLIND ROLLER.—E. Putnam (of Chicago, I.), London, England.
BREECH LOADING ARM.—E. Whitney, New Haven, Conn.
BUTTON HOLE CASING.—V. V. Balmforth, Oakland, Cal.
CARRIAGE SAFETY SHOE.—J. Tiffany, Chicago, Ill.
CHAIR SEATS, ETC.—C. Mason, New York city.
CONDUCTOR'S ALARM, ETC.—T. B. Doolittle, Bridgeport, Conn.
CORK SCREW.—W. R. Clough, Newark, N. J.
DAMPING PRINTING ROLLERS.—W. H. Woodcock, Brooklyn, N. Y.
DRAWING NAILS, ETC.—M. D. Converse, New York city.
ELEVATED RAILWAY.—R. P. Morgan, Jr., Bloomington, Ill.
EMBROIDERING DEVICE.—J. I. West, New York city.
EXCAVATOR.—O. S. Chapman *et al.*, Boston, Mass.
EXPANDING TUBES.—O. Pagan *et al.*, Philadelphia, Pa.
FERTILIZER HOLDER.—W. F. Wheeler, Dorchester, Mass.
FINISHING CLOTH, ETC.—I. E. Palmer, Middletown, Conn.
GOVERNOR.—D. L. F. Chase, Boston, Mass.
GRAIN-BINDING MACHINE.—C. L. Travis, Minneapolis, Minn.
HAMMER EYE MACHINERY.—L. Chapman, Collinsville, Conn.
HARVESTER.—W. Y. Selleck, New York city.
KNITTING MACHINE NEEDLES.—S. Peberdy *et al.*, Philadelphia, Pa.
LAMP.—G. H. Lomax, Massachusetts.
LAMP REFLECTOR, ETC.—H. Craighead, New York city.
LIFE-PRESERVING DRESS.—P. Boyton (of New York city), London, Eng.
LOCKING NUT.—F. L. Bates, Carrollton, Miss.
MAKING SWIVEL HEADS.—W. Edge, Newark, N. J.
MARINER'S COMPASS.—D. Baker, Boston, Mass.
OPENING WINDOWS, ETC.—J. T. Parlour, Brooklyn, N. Y.
PADDLE WHEEL, ETC.—N. T. Edson *et al.*, New Orleans, La.
PEAT FUEL MACHINE, ETC.—F. Dodge, New York city.
PRINTING FROM GELATIN.—E. Edwards, Boston, Mass.
PRINTING MACHINE.—W. H. Woodcock, Brooklyn, N. Y.
RAILWAY BRAKE.—A. Barker, Wyoming, Pa.
RAILWAY SIGNAL.—H. Flad, St, Louis, Mo.
ROCK DRILL.—C. Burleigh, Fitchburg, Mass.
ROTARY ENGINE.—B. T. Babbitt, New York city.
SCREW DRIVER, ETC.—A. Cummings, New York city.
SEWING MACHINE.—J. L. Follett, New York city.
SPOOLING MACHINE.—G. W. Paine, Pawtucket, R. I.
SURGICAL NEEDLE, ETC.—J. C. Holland, New York city.
THREAD-HOLDING DEVICE.—H. Sutro, New York city.
THREAD SPOOL MACHINE, ETC.—D. T. Lyman, Providence, R. I.
TRACTION ENGINE.—W. H. Milliken, Sacramento, Cal.
TREATING SUGAR.—F. O. Matthiessen, New York city.

Recent American and Foreign Patents.

Improved Sight Protector.

Marmaduke H. Mendenhall, Wabash, Ind.—This device is an improvement upon that for which letters patent No. 158,726 were granted January 12, 1875, to the same inventor. The lamp case is pivoted at the bottom to adapt it to rotate. It is also cut away on all sides, and a hinged flap or plate swinging vertically, and a door swinging horizontally, are so combined with the case that, when opened, the lamp may be readily inserted or removed, or the light allowed to diffuse itself freely into the room; or the flap may be turned up while the door remains closed to allow the light to strike the ceiling and illumine the upper portion of the apartment, while the eyes of the persons reading or otherwise employed are shaded and protected.

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Improved Corn Plow.

Linus G. Clawson, Pleasant Hill, Mo.—This implement is of peculiar construction, consisting of two plows of similar form connected together at the forward part by an adjustable bow, which allows the plows to be reversed without being disconnected. They may, by simply turning, and without any adjustment, be made to turn the soil to or from a row of plants. The advantages claimed for this invention are as follows: It is adapted to more varieties of work than any other, possessing the very minimum of draft, is light, easily handled, convenient, durable, and is not liable to get out of order. Any kind of shovel may be used on it, straight, twisted, diamond, wide, or narrow; in addition to which, its reversibility renders it of universal adaptation. The draft is perfectly straight and direct, and as close to the horse as it is possible to get it. Each plow holds the other in an upright position, so that neither can upset, and has a perfectly free and easy side-to-side motion by the handles while in operation. Its entire weight is 65 to 80 lbs.

Improved Vehicle Seat Lock.

Albert E. Van Horn and Joseph Wideman, Sebewaing, Mich.—This consists of a pivoted dog or key of the side board, that is thrown against a T-shaped piece of the seat block, binding it securely into the recessed top plate of the side board, a pivoted pawl securing the dog in locked position by engaging the outer cleat of the same.

Improved Take-Up for Knitting Machines.

Ira Tompkins and Albert Tompkins, Troy, N. Y.—This invention consists, first, in combining the take-up rolls with a pair of gear wheels differing in size, and so connected with intermediate mechanism as that the operation of drawing the fabric from the needles or cylinder will take place at constantly varying points. The objection is thus avoided of having the draw of the take-up always at the same point relatively to the cam, or some similar device which never varies its position. The invention also comprehends an improvement in the means of connecting and disconnecting the take-up roll with the gear wheels that operate it.

Improved Horse Hay Rake.

Gould Platt, Colliersville, N. Y.—This invention consists in suspending a common revolving hay rake from a wheeled frame by means of a properly balanced and adjustable guide frame, for being readily governed by the attendant seated on the wheeled frame.

Improved Addressing Machine.

Charles W. Van Vleet, Waterloo, N. Y.—The type are placed in a galley, with the various addresses properly set up and inked, and paper wrappers are placed beneath a platen, which is pressed down by a weight and raised by the cam. After every impression, the galley is moved a short distance to bring the next address into proper position, and so on for the whole galley, when other prepared galleys may be introduced and printed from in the same manner.

Improved Bluing Case.

Sylvester W. Sheldon, New York city.—This bluing case is made in two parts, the upper part being externally, and the lower part being internally, tapered, to fit one within the other. The upper part is provided with a cavity for holding the bluing and a discharge opening with a covering plate.

Improved Adjustable Top for Carriages.

Almon Clarke, Sheboygan, Wis., assignor to himself and Charles A. Spencer, of same place.—The invention consists of a curved standard, which is attached to the body of the carriage and provided, at the upper end, with a pivoted pulley, operated by means of a turning spring knob and connecting cords. A canopy, with arc-shaped slide piece, is adjusted by a clamping device to the pulley, and set to any inclination thereon.

Improved Steam Engine Governor.

Thomas I. Walsh, Brownsville, Pa.—This is an improvement in the class of devices for indicating steam pressure in boilers, consisting of a piston provided with a central annular recess, and arranged to move freely in a vertical tube or pipe connected with the steam space of the boiler. If the steam pressure is below the regular fixed point to which the boiler is limited by the weighted piston, it will establish the communication of the pipe with the engine channel, so as to admit the unobstructed passage of the steam to the engine; but whenever the pressure in the boiler is increased, the piston is forced by the pressure of the steam on its lower part, which overcomes its weight in upward direction, closing the communication of the pipe with the engine channel, and establishing that with the blow-off pipe, so as to stop the engine and give the signal to the engineer.

Improved Bosom Pad.

John C. Tallman, New York city.—This is a bosom pad made entirely of thin sheet cork, molded or pressed into shape.

Improved Slide for Gas Pendants.

Samuel B. H. Vance, New York city.—This gas pendant is so constructed that the burners may be drawn down to light the gas without disturbing the globe, while it avoids the use of balancing weights or springs. It consists in an arrangement of sliding tubes, the friction between which and stationary tubes holds the former as adjusted.

Improved Box for Packing and Showing Goods.

Francis S. Kinney, New York city.—The invention consists of a box of rhomboidal shape, made with the upper part of its lower end cut away, and provided with a terraced or step false bottom and hinged flaps or false ends. The upper ends of the goods of each upper tier show above the goods of the lower tiers, and the forward side of the goods of the lowest tier may be fully seen through the open lower end of the box.

Improved Egg Tester.

James W. Van Arnam, Watertown, N. Y., assignor to himself and Charles T. Greene, of Newtown, Conn.—An egg-holding branch is arranged to open into a lamp chimney at the top of the flame, or thereabout, and to incline upward in an oblique angle with the chimney; and it flares a little from the lower end upward, in order to receive and hold eggs of different sizes. The simplest way of attaching the egg holder to the chimney is by soldering it; but when attached in that way, the solder is liable to be melted by the heat, making it necessary to apply a water holder, in which water may be kept in contact, so as to keep the heat down.

Improved Apparatus for Cutting Goods on Bias.

Salomon Mayer, New York city.—This invention consists of a feed table with a revolving disk, having a central bias slot and a treadle-acted and knife-grinding clamp piece applied thereto, which, in connection with an adjustable gage piece, is set with the disk plate to any angle, and locked in the required position for cutting the width and angle of the bias strips.

Improved Rotary Engine.

Hermon G. Wood, Sharon, Pa.—This rotary steam engine has movable abutments and two or more eccentric drums or wheels, with side wheels or flanges and a central dividing wheel or flange, revolving in an open cylinder on a central shaft.

Improved Locomotive Ash Pan and Damper.

Walter W. Beach, Esconawba, Mich.—The dampers are hinged to the bottom ends of the ash pan, and fold inwardly between sides or braces, thus always preventing escape of fire, while they are allowed to fold under the bottom, and permit the pan to be cleaned without removal.

Improved Ironing Machine.

George F. Perrenot, Rockport, Ark.—A reciprocating iron carrying frame is mounted on wheels running on rails, which are connected in a frame, one above another, by rods, and arranged to shift up and down in ways in the posts, for shifting the iron on and off the clothes. The iron is suspended from the arms by rods, which are adjusted by nuts for holding the iron the right hight, and they have springs for pressing the iron down and allowing it to rise for passing over seams and the like. The toggle bars, for raising and lowering the rails, are connected together to be worked in unison by a bar, which is connected to a lever and shifting lever, to be worked by the operator, said lever being arranged at the front of the table where the operator stands. It has a catch bar to hold it in the different positions.

Improved Reciprocating Churn.

Wilhelm Howe, Brooklyn, N. Y.—This consists of a swinging churn, provided on the inside with guide plates having inclined grooves, for adjusting therein the detachable perforated dash boards to the quantity of cream in the tub.

Improved Grapple.

George Conklin, Poughkeepsie, N. Y.—The chains for closing the jaws are connected to the ends of arms, and extend directly to and wind on the pulleys of the shaft, which is used to close the jaws. The jaws are pivoted to the frames to afford the requisite leverage to the arms. The guide rods are connected outside of the pivots, and serve only to regulate the opening and closing of the jaws. The frames are double, and have a space between them, in which the jaws are pivoted, and the closing chains and pulleys are arranged for operating them.

Improved Light House Lantern.

Oliver Cook, Darien (Rowayton P. O.), Conn.—The invention consists in a light house lantern provided with a glass dome or cover, having a concave ring reflector hung on gimbals and provided with clamping screw pivots. The pivots of the gimbal are made as screws to enable them to clamp the rings of the gimbal in place when the reflector is adjusted in the proper position to throw the light vertically or at inclination, as may be desired. By this construction the light may be thrown upward against the clouds, and will be reflected by said clouds so that it can be seen at a much greater distance than is possible when the light is thrown from the lantern in a horizontal direction.

Improved Folding Table.

Rudolph Sprigade and John Schnoering, Brooklyn, E. D., N. Y.—This invention consists of a table with longitudinal top sections, hinged to folding leg sections, and locked by hinged side boards, and a pivoted lateral piece for retaining the table sections when in open position.

Device for Setting, Filing, and Jointing Saws.

William Bryson, Unity, Wis.—The invention consists of a couple of blocks and a straight edge, contrived with the latter fastened between the former, so that they clamp on the saw by set screws. The straight edge rests on the points of the teeth of a straight saw to gage them as to length. In the top of the block is a filing notch and an adjustable gage for the file for jointing the teeth; and on each end of the straight edge are adjustable, detachable, and reversible gages, by which to gage the file for beveling and squaring the edges of the teeth. The set consists of an adjustable die in one of the blocks and a screw presser in the other by which to bind the teeth.

Improved Mail Bag Fastening.

James C. Franklin, Lena, Oregon.—In this improved fastening a slotted flap of one side of the bag folds over on hooks projecting from the other side, and a slotted hasp slide, for locking the hooks, folds over on them from rods below, on which it is pivoted, so as to slide under the hooks after receiving them through the slots, to engage with the staple in which the lock is secured.

Improved Combined Wash Bench and Wringer.

Orsemor S. Holden and John S. Corey, Felchville, Vt.—In this invention the wringing rolls and an inclined shelf are supported above or over the wash bench by a frame, which is joined to and forms part of the bench, so that, as the clothes are passed up between the rolls directly from the tub, they are deposited on the inclined shelf, and thereby conveyed to a basket or other receptacle.

Improved Sad Iron.

Thomas J. Ellyson and Aaron O. Askew, Jackson, Tenn.—Between the two faces of the iron is a hollow space, into which the burner extends, from a lamp attached to the heel of the iron for heating it, at the same time that it is being used to avoid the labor and delay of heating it by the stove, and to dispense in warm weather with the hot fires necessary for heating irons. The pivot at the heel of the iron is made hollow for the burner to enter the chamber in this way, and it is formed on the standard of the handle. The lamp is attached to the iron by the studs projecting from the standard and a slotted plate. It also has a latch which swings over and engages the standard, after the studs are adjusted in the slots, to prevent the lamp from becoming detached.

Improved Car Coupling.

Nathan G. Shelley, Stephen P. Bozarth, and David V. Spring, Austin, Tex.—This invention consists of a sliding block within the drawhead, having a plate to cover the lower hole for the pin, and to hold the pin in position for self-coupling. The plate also is acted upon by a spring to keep it in position for holding the pin, and to allow it to be pushed back by the entering link of the other car, to trip the pin and uncover the hole to let the pin fall through the link into the hole. The links are pivoted in the drawheads above the block, so that the one passing over the other when they come together will rise up over the block, while the end of the other hangs low enough to strike the pin-holding plate and push the block back. The links also have a spring over the pivoted end, to control the other end as to the hight.

Improved Exercising Apparatus.

William Arnold Knight, Worcester, Mass.—This invention consists of a table, provided with lifting handles, that are operated against an adjustable combination of spring and weight, that can be used singly or jointly. A graduated machine is thus obtained, which starts from a minimum strain, by gradual increase to maximum strain, and back again to the minimum strain, requiring no sudden effort to overcome a constant or fixed strain, but admitting, by a gradually increasing effort, a regular training and developing of the muscles.

Improved Snap Hook.

J. G. Eberle, Glasgow, Mo., administrator of John Eberle, deceased.—A snap hook is provided with a reverse rear hook, bifurcated to allow the tongue of a buckle to be easily inserted or removed, and shouldered at the rear to prevent the buckle from coming out by a slackening of the strap. This snap is thus adapted to any kind of buckle, is applicable without punch or rivet, and may be readily used by an unskilled person.

Improved Rag Cutting Machine.

William C. Harrison, Goshen, N. Y.—This consists of two revolving cutting rollers, which are adjusted by suitable mechanism in close proximity to each other, to cut the fabric fed thereto by the shearing action of their cutting edges. An adjustable guide regulates the width of the strips, while a square shaft of one roller assists the feeding of the same.

Improved Chair Base.

William T. Doremus, New York city.—This invention consists in a base plate cast with a socket to receive a pivot or screw, and with sockets to receive the legs. Upon the lower side of the top plate are cast pins or points, which enter holes in the legs, and thus farther strengthen the connection. Upon the upper side of the top plate is formed a ring groove to receive a ring rib, formed on a plate secured to the chair seat. These devices serve to regulate and steady the movement of the pivot plate. This construction enables the base plate to be cast without using cores, so that it can be cast readily and with perfect accuracy.

Improved Press for Cider, etc.

Henry Krumsick, Nashville, Ill.—The principal difficulties encountered in interposing elastic blocks between the screw and follower of a press, for the purpose of supplementing the pressure of the screw by expansion of the blocks, have been lack of steadiness and directness of pressure. To remedy this and other defects, the elastic blocks in the present device are arranged between two parallel cross bars of the press frame, one of which is fixed, and the other vertically adjustable, its ends being tenoned and fitted in elongated mortises in the uprights of the frame.

Improved Moth Trap.

Washington Hollis, Pembroke, Ky.—This is a rectangular tin box in the upper part of which is formed a slot to receive the alighting board of a bee hive. Upon the inner end of the box is formed a shallow passage, deep enough for the passage of the bees, and directly over the entrance to the hive. In the top of the box, just in front of the passage, are formed slips, of such a size that the moth millers can crawl through them. In the outer end of the box are formed holes, in which are secured tubes projecting into the said box, and made tapering, the inner ends being made so small that the moth millers can only crawl through them. In the end of the box farthest from the slits is inserted a glass plate so that light can shine through. When once in the trap, the moth millers will be attracted by the light through the glass plate, and will be unable to find their way out.

Improved Ventilating Apparatus for Coal Mines.

Francis Murphy, Streator, Ill.—This apparatus is mainly designed for the purpose of removing deleterious gases, which can only be effected by means of strong currents of air applied directly in the particular localities where they accumulate. This is accomplished by exhausting the gases with an apparatus controlled entirely from the outside. The exhaustion is produced by the creation of a partial vacuum in a properly constructed chamber above the ground. A spiral exhausting fan revolves in close proximity to this chamber, from which airtight tubes extend down through the shaft and along the galleries to branch pipes and receivers at the extreme portions of the works.

Improved Ventilating Damper.

Anson Augustus Schroder, Warren, Ill.—This invention consists in a pipe made with a conical enlargement in its middle part, having openings formed in it. Two shoulders are made at the upper end of said enlargement. By moving a ring in one direction, the cams thereon will pass in beneath the stems of the dampers, and raise said dampers; and by moving the said ring in the opposite direction the dampers will be allowed to drop into their seats, where they will be kept in place by their own weight.

Improved Leather-Punching Machine.

Henry Mott, Pottsville, Iowa, assignor to himself and John C. Callbreath, same place.—This invention consists of a pair of horizontally swinging awl-carrying arms, with foot treadles and springs for swinging them forward and backward, in combination with an intermittingly reciprocating work-holding clamp, and mechanism for feeding it, all contrived for punching straps for harness work, and all other leather work to be sewn in straight lines by hand, easier and more regularly than it can be done with the hand punching awl. The clamp, by which the work is fed to the punches, serves to hold the work suitably for the workman to sew as the punch holes are made.

Improved Car Window.

La Roy S. Starrett, Athol Depot, Mass.—This invention consists of a car window that is applied by a combined hinge and lock mechanism at both sides to the car frame, in such a manner that it may be swung open at either end and retained in position, according to the direction of motion of the car. The window sash is provided with top and bottom and adjustable side weather strips for closing tightly, and the lock and hinge parts with suitable devices for carrying off any dust collecting therein.

Improved Organ Reed Board.

Wesley W. Walker, Brattleborough, Vt.—The object of this invention is to contrive an organ in a compact and simple form with large capacity for different combinations and varieties of music. It consists essentially in the manner of the arrangement of two or more reeds directly over or partly over and partly back of the lower reeds, on one or both sides of an air cell, through which the air is taken from the reeds into the common air cell above the valve through which it passes to the bellows.

Improved Wagon End Gate.

Benjamin F. Bulkley, Southport, Conn.—Cleats are attached to the outer side of the end boards to strengthen them. A rod extends longitudinally along the outer side of the end boards and through holes formed in the cleats to receive it. Upon each end of the rod is formed a hook for the links to be hooked. The links are placed in the eyes of eye bolts, which pass through outer cleats and the ends of the side boards, and have hand nuts screwed upon their outer ends, so that they can be readily loosened to enable the links to be detached from the hooks. With this construction the fastenings can be readily and quickly fastened and unfastened to secure and release the end boards.

Improved Farm Fence.

Stephen Stout, Tremont, Ill.—This consists in securing between the horizontal wires of a wire fence a board provided with spikes. Vertical wires are employed to fasten said board in a simple manner.

Improved Coal Holder.

Samuel M. Whiteside and Amos C. Holliday, Wheeling, W. Va.—This invention relates to a receptacle for coal to be placed in the grate or stove, to contain a supply of coal for the fire, and for dispensing with the objectionable coal bucket. The box turns forward on pivots to allow the coal to be removed, and closes back tightly with the cap when turned again to an upright position.

Improved Automatic Car Brake.

Fielding L. Kirtley, Cleburne, Texas.—The object of this invention is to provide a means for the automatic application of brakes to the cars of a railway train, and it consists in a loosely moving drawbar attached to the car by means of bolts passing through a central longitudinal slot, and having its sides wrought into two rack bars which mesh with pinions upon two windlass shafts, which arrangement, when the locomotive is slowed, causes the impact of the cars to drive up the drawbars, and wind up cords upon the windlass shafts, which cords communicate with and apply the brakes to the wheels. The invention also consists in the combination with the rack bar of a locking device to prevent the application of brakes in backing, and in a device for maintaining the brakes applied when stopping upon an incline.

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Notes & Queries

F. J. will find Professor Böttger's recipe for a depilatory on p. 107, vol. 30.—F. R. S. can make a colorless varnish by the process described on p. 150, vol. 29.—J. T. W. will find that the field camera is described on p. 58, vol. 31.—A. J. T. will find that induction coils are described on pp. 215, 218, 363, 378, 379, vol. 30.—R. N. will find a full description of the process of lithography on p. 298, vol. 31.

(1) W. H. says: I have found in California a deposit of almost pure silicate of alumina. It is entirely free from any metal, and contains about 2 per cent of silicate of magnesia. Is there any use for it? A. It could be used for filling the walls of fireproof safes; and if it could be easily handled and cut into blocks, it might be employed in the lining of furnaces, or in similar cases where great heat is encountered.

(2) P. I. O. asks: If a ball of iron, or other substance of greater specific gravity than water, be placed in a vessel (of sufficient strength) full of water, and submitted to powerful hydraulic pressure, would the pressure cause the water in the vessel to float the ball? A. Yes, if the water were sufficiently compressed. It would, however, require a machine of extraordinary strength, as a pressure of 1 atmosphere only increases the density of water about 0·0000033.

(3) W. H. R. asks: Will a mark on a tree indicating high water be permanent, or higher up by the growth of the tree? A. If the tree has attained its growth, the change in the position of the mark will be scarcely perceptible. In other cases it may change considerably. We have heard of "blazes" made on trees which were afterward found to be high above the reach of a "blazer" on the ground.

(4) J. T. H. asks: If a belt slips, does it slip on the driving pulley or the one driven? A. In most cases, but not always, on the driven pulley.

(5) H. C. S. says: I made a piece of leather hose 4½ feet long and 2½ inches in diameter, and put a water pressure upon it of 275 lbs. to the square inch. Would a length 50 feet long, all things being equal, stand the same pressure? A. Yes.

(6) W. J. F. asks: How many square feet of cooling surface are usually allowed per horse power in a surface condenser? A. It is a common rule to allow from ⅛ to ¾ as much condensing surface as the heating surface of the boiler.

(7) G. S. C. asks: What makes some steam boilers, if the water is cold when the fire is started, give a clacking and hammering noise internally? A. It is no doubt due to sudden expansion of parts of the boiler, caused by the circulation of the water as it becomes heated.

(8) W. R. H. says: I read that Lieutenant Hitchcock of the United States Coast Survey discovered what is apparently a spring of fresh water at sea. Are there any more localities in the ocean where fresh water can be obtained? A. Fresh springs in salt water are by no means uncommon. We remember to have seen one in a creek in North Carolina, the water of the creek being quite salt.

(9) J. B. says: We use salt water in a steam boiler. We have no condenser, and do not know how to make one. We can get sulphurous water, but think that will be as hard on the boiler as salt water. What would you advise? A. It will be necessary for you to blow off frequently, so that the saturation of the water in the boiler does not become very high. Even with this precaution, scale will form in the boiler, and should be removed every few weeks.

(10) J. E. H. says: Some time ago I saw a recipe in the SCIENTIFIC AMERICAN for cleaning guns by using quicksilver. It stated that the quicksilver would form an amalgam with the lead in the barrel of the gun. I have tried it and have signally failed. I then took some shot and put in the mercury to see if it would form an amalgam; and the shot still remain in it as perfect as when first put in. What is wrong? A. If you will melt the shot you allude to, and draw off the clear metal from the oil and plumbago with which they are covered, you will have no difficulty in combining it with the mercury. For the same reason you will see that it is necessary to first remove all the carbon, etc., from the interior of the barrel of the gun before the required action will take place.

(11) L. G. P. asks: What kinds of gums can be dissolved in sulphuric ether? A. Most gums are soluble in ether.

1. How can I color collodion? A. Use any of the aniline colors. 2. What will dissolve collodion after it is dry? A. Ether containing a little alcohol.

(12) J. H. S. asks: 1. To how many grains (by weight) of best rifle powder is one grain of good gun cotton equal? A. One part by weight of gun cotton is equal in projectile power to 4·5 or 5 parts of gunpowder. 2. How is gun cotton manufactured for use in fire arms? A. The cotton is steeped in a mixture of equal parts of strong sulphuric acid, specific gravity=1·84, and fuming nitric acid for about 15 minutes. Gun cotton has not been adopted in practice as a good substitute for gunpowder; its large bulk, coupled with the fact that the explosion is attended with the evolution of much water and nitrous acid, render it inconvenient as a substitute for powder. 3. Is it more dangerous than gunpowder? A. Yes; gun cotton is liable to spontaneous combustion. In some cases it has been known to ignite at a temperature of 43°. A small magazine filled with gun cotton in the Bois de Vincennes, Paris, was exploded by the sun's rays. The combustion of gun cotton, unlike gunpowder, takes place almost instantaneously, and for this reason it is liable to injure or rupture the fire arm in which it is used.

(13) F. W. B. asks: Are there any acids that will eat into or soften the surface of rocks? A. Most of the materials forming rocks are either partially or wholly soluble in acids, or mixtures of acids. They are not all soluble in the same acid. As you failed to state any particular variety of rock, we must omit giving you here a complete dictionary of solubilities.

(14) B. H. W. asks: What substance is used to cement the seams of gas bags? A. For this purpose a cement used is obtained by dissolving gum rubber in hot naphtha, which is then allowed to evaporate until of the consistence of a thick paste. The seams are cemented with this, and placed under great pressure for some time. They are then (usually) countercovered by a strip of the same material as the bag. This is fastened on by means of the above cement, so as to form a binding. When this is finished, it is again placed under pressure. A bag, so prepared, will stand 600 lbs. pressure, and is generally warranted to stand 1,000 lbs.

(15) E. E. asks: What would be the best to fill an ice box between the outside and inside of the box? A. Charcoal.

(16) W. C. asks: Is there a chemical that will dissolve gutta percha, and will dry as fast as bisulphide of carbon? A. Bisulphide of carbon is by far the best solvent for gutta percha, we believe, thus far discovered; but if the gum be digested for some time in hot naphtha, a solution in that liquid may be obtained. But as naphtha, like carbon bisulphide, is an extremely volatile liquid, and when its vapor is mixed with air forms a terribly explosive mixture, it follows that, to obtain the desired solution without a prodigal waste of the solvent and its accompanying danger, it is necessary that the materials be inclosed in a strong, airtight vessel, and heated over a water bath so as to insure a uniform degree of temperature, which should not be allowed to exceed 100° Fah.; and even then we should not consider the above method free from danger in inexperienced hands.

(17) C. G. H. says: On April 13 I was carrying an umbrella in a snowstorm. I touched the frame of the umbrella and received a spark of electricity. On presenting my finger, I could plainly see a spark ⅛ of an inch long. What is the cause? A. Occasionally, during a snowstorm such as you mention, or when for some reason the air is extremely dry and the atmosphere becomes very highly electrified, like strange electrical phenomena often occur. Your umbrella, in this case, probably acted the part of Franklin's kite, and your body formed the conducting link to the earth.

(18) E. W. P. asks: How can I make powdered charcoal into a porous cake for use as a filter? A. One method consists in pulverizing animal charcoal until reduced to an impalpable powder. This is mixed with a definite proportion of Norway tar, and a compound of other combustible substances. The combined materials are then properly amalgamated with liquid pitch, and the whole kneaded up into a homogeneous plastic mass which admits of being molded into slabs or blocks of any required dimensions and shape. These blocks, having been allowed to dry and harden, are subsequently carbonized by being subjected to a process of incineration by heat; and in this manner all the combustible ingredients are burnt out, leaving nothing behind but the animal charcoal in the form of a block of charcoal, permeated throughout by innumerable pores.

(19) W. H. says: 1. You say that, by coating a room with oxide of zinc and glue size, and when dry, coating with a solution of chloride of zinc, I can obtain a good gloss; must there be any glue in the chloride solution to bind it? A. It is not necessary. 2. What strength of solution of chloride is required? A. Use a strong solution. 3. Chloride of zinc is extremely dear here. Is there any substance that can be used to produce same results and be cheaper? A. We do not know of any substitute other than good varnish. 4. Does the above compound affect colors? A. Yes; some colors are apt to be partially bleached when mixed with it. 5. Is the chloride of zinc hard to make? A. No; dissolve metallic zinc or its oxide in a small quantity of hydrochloric acid until it will dissolve no more; this solution is then ready for use. When applied to the coating of zinc oxide, it combines with it to form a subchloride or oxychloride of zinc, which is neutral. 6. Is silicate of soda a strictly waterproof substance? A. It is not. 7. What can I add to its brittleness to keep it from becoming cracked and mealy when exposed to the air a short time? A. We do not know that you can better it at all. 8. Could I use this mixture on plastered walls to keep water from staining through kalsomine? A. It might be made use of for this purpose, but we do not think it would be very lasting. 9. Would it peel off in damp places? A. Yes.

(20) E. C. S. asks: When it is exactly noon at any given point on a given meridian, is it exactly noon at every other point on the same meridian? A. Yes. 2. I read that the variation in the length of the solar day is owing to two distinct causes, the inequality of the earth's motion around the sun, and the inclination of its axis to the plane of its orbit; and that from these two causes arises the difference between sun time and clock time. I can see how the earth's unequal motion may make the solar day more or less than 24 hours; and I can see how the inclination of its axis may affect the time of sunrise and sunset, and the length of day and night; but I cannot see how it affects the length of the solar day or makes sun fast and slow. A. If the books state that the variation of the length of the solar day is due to the inclination of its axis to the plane of its orbit, they can only allude to the variation in the duration of daylight from summer to winter; and if they speak of the inequality of the earth's motion around the sun, they mean the yearly motion, during which the earth recedes in spring time from the sun, and retards her velocity, while in the fall she approaches the sun, and accelerates. The daily rotation is perfectly uniform, as proved by observations of the stars, which show that the sidereal days, of which the length is only 23 hours and 56 minutes very nearly, never vary in length. The difference between solar time and the time of a well regulated clock would not exist if the earth's yearly orbit were a circle, and her yearly motion uniform. This difference, which is commonly described in the almanacs as "sun fast" and "sun slow," is caused by the inequality in the yearly motion of the earth, by which the apparent motion of the sun along the signs of the zodiac (and which, on an average, is 59 minutes and 3 seconds of a degree per day) becomes retarded or accelerated: the difference of this apparent irregular motion, with that of a sun whose apparent motion is regular, constitutes the difference between the so-called solar time and mean time. For instance, from June to September, the earth recedes from the sun, and its velocity is retarded, and the sun's apparent motion along the zodiac is also retarded, so that the statement in the almanac, "sun slow," is correct.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Commercial Sponges. By S. H. T.
On Flower Growing. By W. H. M.
On the Tides. By A. McN.
On Disasters at Sea. By J. F. J.
On the Locomotive. By J. F. J.
On Railway Rails. By J. P. T.

Also enquiries and answers from the following.

C. N. F.—S. T.—L. D. D.—A. W.—P. F. M.—C. N. F—F. W. J.—B. S. K. O.—C. F. A.—E. J. F.—W. L. D.—C. J. B.—C. S.—C. D. G.—S. G., Jr.—H. S.—J. P. M.—E. F. O.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who sells dynamite, dualin, and lithofracteur? Who sells steam engine indicators? Why do not makers of watch-making machinery advertise in the SCIENTIFIC AMERICAN? Where can pure tallow, for cylinder lubrication, be obtained?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

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4,749.—J. Nolan, Malone, N. Y., U. S. Water wheel. May 19, 1875.
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4,751.—M. Lesser, Montreal, P. Q. Cigars and cigar molds. May 19, 1875.
4,752.—L. J. Herard, Montreal, P. Q. Cooking stove. May 19, 1875.
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Vol. Lxxxix.,

FOR YEAR ENDING

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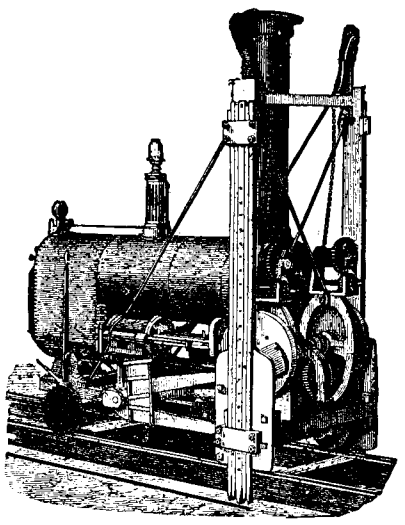

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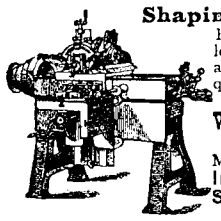

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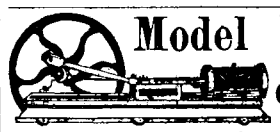

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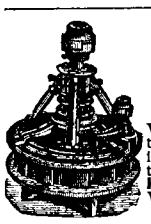

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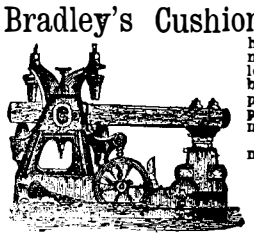

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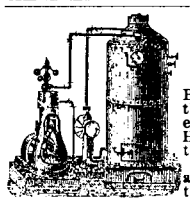

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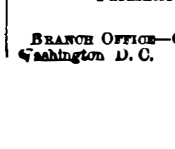

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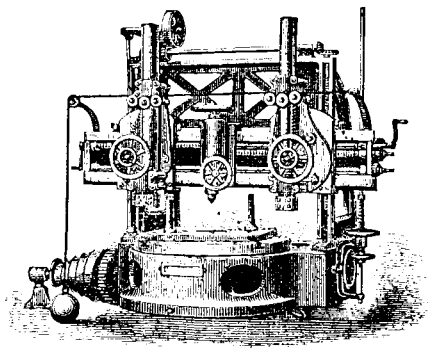

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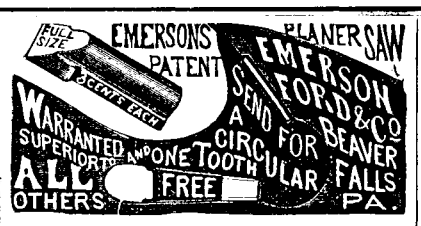

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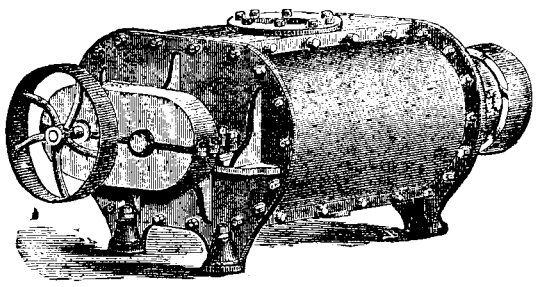

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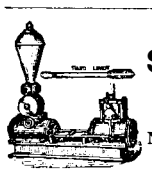

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